NATIONAL SCIENCE FOUNDATION

HEARINGS

BEFORE A

SUBCOMMITTEE OF THE COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE HOUSE OF REPRESENTATIVES

EIGHTY-FIFTH CONGRESS

SECOND SESSION

ON

AMENDMENTS TO NATIONAL SCIENCE FOUNDATION ACT AND RELATED LEGISLATION

MAY 13, 14, 15, 16, AND JULY 24, 1958

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NATIONAL SCIENCE FOUNDATION

TUESDAY, MAY 13, 1958

HOUSE OF REPRESENTATIVES,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
SUBCOMMITTEE ON HEALTH AND SCIENCE,
Washington, D. C.

The subcommittee met at 10 a. m., pursuant to notice, in room 1334, New House Office Building, Hon. John Bell Williams (chairman of the subcommittee) presiding.

Mr. WILLIAMS. This morning the Subcommittee on Health and Science is beginning 4 days of hearings on a number of bills dealing with the promotion of education and research in the sciences.

Instead of inserting the bills in the record in their numerical order, I believe it would be preferable to group them according to their content.

In the first group belong H. R. 2450, introduced by Congressman Holland of Pennsylvania; H. R. 9918, introduced by Congressman Long of Louisiana, now deceased; and H. R. 10180, introduced by Congressman Sikes of Florida, which seek to encourage the training of additional engineers and scientists by providing supplementary salary grants for teachers in these fields, and scholarships and fellowships for engineering and science students.

In the second group belong H. R. 4218 and H. R. 10456, both introduced by Congressman Price of Illinois, and H. R. 10464, introduced by Congressman Van Zandt of Pennsylvania, which provide incentive awards for high-school students who pass examinations in mathematics and provide fellowships for high-school teachers of science and mathematics.

In the third group is H. R. 10293, introduced by Congressman Dawson of Illinois, which seeks to establish a national scientific research reserve fund.

In the fourth category we have H. R. 11257, introduced by the chairman of this committee, Congressman Harris, at the request of the National Science Foundation. This bill is designed to make certain changes in Foundation procedures and provide broader authority to the Foundation for participation in international scientific research.

The subcommittee is not unaware that other committees of the Congress have pending before them legislation dealing in a general way with the issue of Federal aid to education. As we all know, the issue of providing Federal aid to education is highly controversial in that no specific constitutional authority provides for an expenditure of Federal funds for public education. Historically, the responsibility for public education has been considered on good authority to be among the powers exclusively reserved to the several States by the Constitution. On the other hand, we must recognize a degree of Fed-

eral responsibility for promoting scientific research, and it is my hope that as a result of these hearings the subcommittee will be able to report favorably legislation which will meet that responsibility without usurping the powers and prerogatives of the several States and without doing violence to the American Constitution.

Following each of the bills, there will be included in the record the reports which the subcommittee has received from the departments and agencies of Government.

(The bills and reports referred to are as follows:)

[H. R. 2450, 85th Cong., 1st sess.]

A BILL To amend the National Science Foundation Act of 1950 to encourage the training of additional engineers and the expansion of facilities for engineering education by providing supplementary salary grants for engineering teachers and scholarships and fellowships for engineering students

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That (a) the National Science Foundation Act of 1950 is amended by striking out the first section and inserting in lieu thereof the following:

"TITLE I

"SHORT TITLE

"SECTION 1. This Act may be cited as the 'National Science Foundation Act of 1950'."

(b) Section 3 (c) of such Act is amended by inserting "under this title" after "activities of the Foundation".

(c) Sections 3, 4, 5, 6, 11, 12, 13, 14, 15, and 16 of such Act are amended by striking out "this Act" wherever it appears and inserting in lieu thereof "this title".

(d) Section 16 (a) of such Act is amended by inserting "under this title" after "powers and duties".

SEC. 2. The National Science Foundation Act of 1950 is further amended by adding at the end thereof the following new title:

"TITLE II

"PART A—DECLARATION OF POLICY AND DEFINITIONS

"DECLARATION OF POLICY

"SEC. 201. It is the policy of the Congress and the purpose of this title to assist in providing an adequate supply of trained professional engineers in the United States, and thereby to protect and promote the general welfare and the national defense and security of the United States.

"DEFINITIONS

"SEC. 202. As used in this title—

"(1) the term 'engineering course' includes any course or group of courses (regardless of whether given at the secondary, undergraduate, or post-graduate level) which is determined by the Foundation, after consultation with the Engineers' Council for Professional Development, to be (A) within any field of engineering, (B) a prerequisite of an adequate engineering education, or (C) necessarily related to an adequate engineering education;

"(2) the term 'approved school of engineering' means an educational institution in the United States which (A) admits as regular undergraduate students only students having at least a secondary education or its recognized equivalent, (B) offers and conducts an educational program of at least four academic years leading to a baccalaureate degree in engineering (whether or not is also offers a post-graduate educational program in engineering), and (C) is accredited by the Engineers' Council for Professional Development or, in the case of an educational institution which has not conducted such a program for a sufficient period to be so accredited, is approved by the Foundation as meeting all the other standards for accreditation;

"(3) the term 'engineering teacher' means any individual teaching an engineering course, whether at the secondary, undergraduate, or post-graduate level;

"(4) the term 'United States', when used in a geographical sense, means the several States, Alaska, Hawaii, the Commonwealth of Puerto Rico, and the District of Columbia; and

"(5) the term 'congressional district', at any given time, means a congressional election district as established pursuant to the most recent reapportionment of Representatives under section 22 of the Act of June 18, 1929 (2 U. S. C. 2a), and includes the Territory of Alaska, the Territory of Hawaii, and the Commonwealth of Puerto Rico.

"PART B—AID TO ENGINEERING TEACHERS

"STATEMENT OF PURPOSE

"SEC. 211. It is the purpose of this part to encourage engineering teachers at approved schools of engineering to continue in the teaching profession, and to prevent such teachers from leaving the teaching profession to seek higher-paying positions elsewhere, by providing supplementary salary payments to bring their total income up to the level of income generally received by engineers of comparable qualifications in private industry.

"AMOUNT OF PAYMENTS

"SEC. 212. (a) The National Science Foundation (referred to in title as the 'Foundation') shall pay to any approved school of engineering which has applied therefor in accordance with regulations prescribed by the Foundation and has entered into the agreement described in section 213, with respect to each engineering teacher at such school, such amounts as, when added to such teacher's regular salary as a member of the faculty of such school, will make his income substantially equal to the average income of industrial and other nonacademic engineers of comparable qualifications (as determined by the Foundation). Amounts paid to any school of engineering under this section with respect to an engineering teacher shall be promptly paid by the school to such teacher as a supplementary salary grant.

"(b) The determination of the average income of industrial and other nonacademic engineers of given qualifications, for purposes of subsection (a), shall be made from time to time by the Foundation.

"(c) Payments to any approved school of engineering under subsection (a) shall be made at such times and in such manner as the Foundation shall determine to be appropriate. The amount of such payments may from time to time be varied by the Foundation, by reason of changes in the regular salary or qualifications of any engineering teacher with respect to whom they are made, or by reason of changes in the average income of industrial and other nonacademic engineers, but the teacher and the school involved shall be notified of any such variation at least thirty days in advance of its effectiveness.

"AGREEMENTS BY SCHOOLS OF ENGINEERING

"SEC. 213. Before any payments may be made to an approved school of engineering under section 212, such school shall enter into a written agreement with the Foundation (1) guaranteeing that any amounts received by it under section 212 with respect to an engineering teacher will be paid to such teacher as a supplementary salary grant in accordance with this part, without any reduction by reason of such payment in the regular salary otherwise payable to such teacher; (2) containing assurances that it will keep the Foundation currently informed with respect to the salary regularly payable to all engineering teachers on its faculty; and (3) containing such other information and assurances as the Foundation may require for the purpose of this part.

"PERIOD OF TEACHER'S ENTITLEMENT

"SEC. 214. The supplementary salary grant provided by this part for an engineering teacher at an approved school of engineering shall be payable to such teacher from and after the first day of the month in which such school enters into the agreement described in section 213, and shall continue to be payable to such teacher until he ceases to be an engineering teacher in good standing at such school.

"PART C—SCHOLARSHIPS

"STATEMENT OF PURPOSE

"SEC. 221. It is the purpose of this part to encourage exceptionally qualified high school graduates with special interest and ability in the field of engineering to pursue their education in such field at the college level, by awarding them scholarships to pay the expenses incident to the attainment of a baccalaureate degree in engineering.

"AWARD OF SCHOLARSHIPS

"SEC. 222. (a) The Foundation shall provide for the holding of annual competitive examinations in each congressional district to determine the individuals who will be awarded scholarships from that district under this part. The specific time, place, and manner of holding each such examination shall be prescribed by the Foundation. Such examinations shall be held sufficiently early in each year (beginning with the calendar year 1957) to permit the participants who are awarded scholarships to begin their education under such scholarships at the fall term in such year.

"(b) Individuals desiring to compete in such examinations shall make written application therefor in such manner and form (subject to subsection (c)) as the Foundation shall prescribe. The Foundation shall prescribe regulations setting forth the minimum qualifications for participation in such examinations, including requirements with respect to the engineering courses which an applicant must have completed at the secondary school level and the scholastic grade average which he must have maintained at that level. No individual shall be eligible to compete in any such examination unless he will have completed his secondary education (or the recognized equivalent thereof) in time to begin his education under a scholarship at the fall term in the year in which the examination is held, and no individual (except as provided in subsection (f)) shall be eligible to compete in any such examination if at the time of the examination he has already begun his education at an approved school of engineering or any other institution of higher education. No individual shall be eligible to compete in any such examination unless he is a resident of the congressional district in which it is held and either is a citizen of the United States or an alien lawfully admitted to the United States for permanent residence.

"(c) Each application to compete in an examination under this section shall be initially submitted by the applicant to the Representative in Congress, Delegate, or Resident Commissioner representing the congressional district in which he resides, and shall be forwarded by such Representative, Delegate, or Resident Commissioner, together with a certification as to whether or not the applicant actually resides in such district, to the Foundation.

"(d) Thirty scholarships (or, if less than thirty of the participants in any competitive examination attain the minimum qualifying grade as determined by the Foundation, a number of scholarships equal to the number of participants who attained such grade in the examination) shall be awarded each year to individuals from each congressional district. Such scholarships shall be awarded, in order of merit, solely on the basis of the competitive examination held for that district in that year. In the event that any participant is entitled to a scholarship on the basis of his performance in any such examination but is unable or does not desire to pursue his education at an approved school of engineering at the fall term in the year in which the examinaion is held, his scholarship shall be awarded to the participant from the same congressional district who is next in line in order of merit (with a grade at least equal to the minimum qualifying grade as determined by the Foundation) after those already awarded scholarships.

"(e) As soon as practicable after the completion of such competitive examinations in each year, the Foundation shall notify each Representative in Congress, and each Delegate and the Resident Commissioner, of the names of the individuals awarded scholarships from his congressional district as a result of such examinations.

"(f) (1) In the event that less than thirty scholarships are awarded in any year under subsection (d) to individuals from any congressional district, the scholarships not so awarded in that district shall be awarded by the Foundation, in time to permit the recipients thereof to begin their education thereunder at the fall term in such year, to individuals from other congressional districts who participated in the competitive examinations for such year and attained the minimum qualifying grade as determined by the Foundation but were not

awarded scholarships under subsection (d). The individuals awarded scholarships under this paragraph shall be selected on the basis of their performance in the examinations and such other factors (including the desirability of the widest possible geographical distribution of scholarships under this part) as the Foundation may consider appropriate.

"(2) Any scholarships which are initially available in any year as provided in subsection (d), but which are not awarded either under subsection (d) or under paragraph (1) of this subsection, shall be awarded, under regulations to be prescribed by the Foundation, to individuals already attending approved schools of engineering who are in the upper 10 per centum of their classes at such schools and who will continue under such scholarships to pursue their engineering courses.

"(g) An individual awarded a scholarship under this part shall not be eligible, while attending an approved school of engineering under such scholarship, to receive any education, training, or other benefits under part VII or VIII of Veterans' Regulation Numbered 1 (a) or title II of the Veterans' Readjustment Assistance Act of 1952.

"SELECTION OF SCHOOL

"SEC. 223. An individual awarded a scholarship under this part may pursue his engineering course under such scholarship at any approved school of engineering in the United States which agrees to admit him and to accept the payments made on his behalf under section 224 in lieu of the tuition and other charges customarily imposed.

"PAYMENTS TO APPROVED SCHOOLS OF ENGINEERING

"SEC. 224. (a) The Foundation shall pay to each approved school of engineering, with respect to each student attending such school under a scholarship awarded under this part, an amount equal to the actual cost to such school (as determined by the Foundation without regard to the school's other income and resources) of educating such student and providing facilities (other than meals and lodging) in connection therewith. Such payment shall be in lieu of the tuition and other charges (except charges for meals and lodging) imposed generally on students at such school.

"(b) Payment to an approved school of engineering under subsection (a) with respect to any student shall be made only for the period of such student's entitlement under his scholarship as determined under section 226, and within such period shall be made at such times and in such manner as the Foundation shall prescribe.

"DIRECT PAYMENTS TO SCHOLARSHIP HOLDERS

"SEC. 225. (a) The Foundation shall pay directly to each individual who holds a scholarship awarded under this part an allowance of $100 a month, for each month during any part of which he is actually attending school under such scholarship, to pay the living expenses of such individual (including his meals and lodging and any supplies, books, equipment, and other items which are reasonably necessary to his engineering education and which are not made available to him without charge by the school).

"(b) Payment to any individual of an allowance under subsection (a) shall be made only for the period of such individual's entitlement under his scholarship as determined under section 226, and within such period shall be made at such times and in such manner as the Foundation shall prescribe.

"PERIOD OF ENTITLEMENT UNDER SCHOLARSHIPS

"SEC. 226. (a) Except as provided in subsection (b), the period of entitlement of any individual under a scholarship awarded under this part shall extend from the first day of the month in which he begins to pursue his engineering course under such scholarship at an approved school of engineering to the last day of the month in which he receives his first post-secondary school degree from such school.

"(b) (1) An individual's period of entitlement under a scholarship awarded under this part shall immediately terminate if he ceases to pursue his engineering course in continuous attendance at the school which he selected under section 223, or if he ceases to meet any of the academic, disciplinary, and other standards applicable to students generally at such school; but an individual's period of entitlement shall not be terminated by his absence from the school during a

regular summer vacation or by a leave of absence of not more than twelve months duly granted by the school.

"(2) The Foundation may require, as a condition of any payments under sections 224 and 225 with respect to an individual awarded a scholarship under this part, that the individual and the approved school of engineering which he is attending submit such reports and furnish such information concerning the individual's academic progress, the use of amounts paid under such sections, and any related matters, as the Foundation may request.

"PART D—GRADUATE FELLOWSHIPS

"STATEMENT OF PURPOSE

"SEC. 231. It is the purpose of this part to increase the number of engineering teachers at secondary schools, while encouraging graduates of approved schools of engineering to pursue postgraduate engineering courses, by awarding fellowships to such graduates on condition that they devote a period of time (during which they will be paid supplementary salary grants) to the teaching of engineering courses in secondary schools.

"AWARD OF FELLOWSHIPS

"SEC. 232. Any individual holding a baccalaureate degree in engineering from an approved school of engineering, if he enters into the agreement described in section 233 and makes application under this part within such time and in such manner and form as the Foundation shall prescribe, shall be awarded a three-year graduate fellowship by the Foundation as provided in this part. Such fellowship shall be used by the holder thereof only for the purpose of acquiring one or more postgraduate degrees in engineering at an approved school of engineering, and shall not become effective until the completion by the holder of the performance of his obligations under such agreement.

"AGREEMENTS BY FELLOW APPLICANTS

"SEC. 233. (a) Before a graduate fellowship may be awarded to any individual under this part, such individual shall enter into a written agreement with the Foundation promising that he will serve for a period of three academic years as an engineering teacher at a duly accredited secondary school in the United States, beginning as soon after the award of the fellowship as he is able to secure a position as a teacher at such a school (and in any event within such period as the Foundation shall designate).

"(b) The Foundation shall assist any individual awarded a fellowship under this part, upon the request of such individual, in securing a position as a teacher of engineering courses at a duly accredited secondary school in the United States.

"(c) The involuntary termination of an individual's service as a teacher of engineering courses at any secondary school, not due to incompetence or misconduct on his part, shall not constitute a failure to perform his obligations under the agreement or an interruption of the performance of such obligations if he proceeds without delay to seek a similar position at another such secondary school and secures such a position within a period to be prescribed by the Foundation. The absence of such individual from his teaching duties during a regular summer vacation, or during a leave of absence duly granted by the school, shall not constitute an interruption of the performance of such obligations. Any other termination of such an individual's service as a teacher of engineering courses at a secondary school, and any other failure by such an individual continuously to perform his teaching duties at such school, shall constitute a failure by such individual to perform his obligations under such agreement.

"SUPPLEMENTARY SALARY GRANTS TO INDIVIDUALS PERFORMING TEACHING OBLIGATIONS UNDER AGREEMENTS

"SEC. 234. (a) The Foundation shall pay to each individual who has been awarded a fellowship under this part and is serving as a teacher of engineering courses at a duly accredited secondary school under an agreement as described in section 233, during the entire period of the service required by such agreement, such amounts as, when added to the regular teacher's salary which he is receiving for such service, will make his income substantially equal to the average

income of industrial and other nonacademic engineers of comparable qualifications (as determined by the Foundation).

"(b) The determination of the average income of industrial and other nonacademic engineers of given qualifications, for purposes of subsection (a), shall be made from time to time by the Foundation.

"(c) Payments to any individual under this section shall be made at such times and in such manner as the Foundation shall determine to be appropriate. The amounts of such payments may from time to time be varied by the Foundation by reason of changes in the individual's regular salary or qualifications or by reason of changes in the average income of industrial and other nonacademic engineers, but the individual and the secondary school involved shall be notified of any such variation at least thirty days in advance of its effectiveness.

"(d) The Foundation may require the inudividual and the secondary school involved to furnish, as a condition of payments to such individual under this section, such information and assurances (including, if necessary, assurances by the school that it will not reduce such individual's regular salary by reason of such payments) as the Foundation may determine to be appropriate for the purpose of this part.

"SELECTION OF SCHOOL

"SEC. 235. An individual who has been awarded a fellowship under this part, and who has completed the performance of his obligations under the agreement described in section 233, may pursue his postgraduate engineering course under such fellowship at any approved school of engineering in the United States which agrees to admit him as a candidate for one or more postgraduate degrees in engineering and to accept the payments made on his behalf under section 236 (a) in lieu of the tuition and other charges customarily imposed.

"PAYMENTS UNDER FELLOWSHIPS

"SEC. 236. (a) The Foundation shall pay directly to any approved school of engineering, on behalf of each individual pursuing a postgraduate engineering course at such school under a fellowship awarded under this part, an amount equal to the actual cost to such school (as determined by the Foundation without regard to the school's other income and resources) of educating such individual and providing facilities (other than meals and lodging) in connection therewith. Such payment shall be in lieu of the tuition and other charges (except charges for meals and lodging) imposed generally on individuals pursuing such courses at such school. Such payment shall be made with respect to any holder of a fellowship only for the period of his entitlement thereunder as determined under section 237, and within such period shall be made at the times and in the manner prescribed by the Foundation.

"(b) The Foundation shall pay directly to each individual pursuing a postgraduate engineering course at an approved school of engineering under a fellowship awarded under this part, throughout the period of his entitlement under the fellowship as determined under section 237, an amount per month (as living expenses) equal to the total amount per month which he was receiving with respect to his service as a teacher at a secondary school under the agreement described in section 233 (including both his regular teacher's salary and his supplementary salary grant under section 234) immediately prior to the completion of such service under such agreement.

"PERIOD OF ENTITLEMENT UNDER FELLOWSHIPS

"SEC. 237. (a) Except as provided in subsection (b), the period of entitlement of any individual under a fellowship awarded under this part shall not commence until he has completed the performance of his obligations under the agreement described in section 233, and shall extend from the first day of the month in which (after completing the performance of such obligations) he begins to pursue his postgraduate engineering course under such fellowship at an approved school of engineering to the last day of the month in which he receives his doctorate in engineering from such school.

"(b) (1) No individual's period of entitlement under a fellowship awarded under this part shall be more than three calendar years; and any such period shall immediately terminate if the individual ceases to pursue a postgraduate engineering course, in continuous attendance at the school which he selected under section 235, which will lead to a master's degree or a doctorate in engineering, or if he ceases to meet any of the academic, disciplinary, and other

standards applicable to postgraduate students at such school. An individual's period of entitlement shall not be terminated by his absence from the school during a regular summer vacation or by a leave of absence of not more than twelve months duly granted by the school; and any such leave of absence shall be excluded in the computation of the three-year period referred to in the preceding sentence.

"(2) The Foundation may require, as a condition of any payments under section 236 with respect to an individual awarded a fellowship under this part, that the individual and the approved school of engineering which he is attending submit such reports and furnish such information concerning the individual's academic progress, and related matters, as the Foundation may consider necessary for the purpose of this part.

"PART E—GENERAL PROVISIONS

"FEDERAL CONTROL OF EDUCATION PROHIBITED

'SEC. 241. Nothing contained in this title shall be construed as authorizing any department, agency, officer, or employee of the United States to exercise any direction, supervision, or control over the curriculum or program of instruction of any educational institution or over its administration or personnel.

"ADMINISTRATION

"SEC. 242. (a) The Director of the Foundation, in accordance with policies established by the National Science Board, shall exercise the powers and duties vested in the Foundation by this title.

"(b) In the administration of this title, the Foundation shall regularly consult with the Engineers' Council for Professional Development.

"(c) The Foundation shall make regular studies and investigations of the programs established by this title, and shall make a full report to the Congress at the beginning of each regular session thereof with respect to the administration of each of such programs, including the recommendations of the Foundation for needed revisions in such programs.

"(d) In the administration of this title, the Foundation shall have the authority and powers provided in sections 11 and 14 of this Act to the extent that such authority and powers are determined by the Foundation to be necessary or appropriate for the purpose of this title.

"(e) Scholarships awarded under part C of this title and graduate fellowships awarded under part D of this title shall be in addition to any scholarships and graduate fellowships awarded under section 10 of this Act.

"PAYMENTS TO INDIVIDUALS AND SCHOOLS

"SEC. 243. (a) Any payment provided for by sections 212, 224, 225, 234, and 236 shall be made by the Treasurer of the United States upon the certification of the Foundation.

"(b) Notwithstanding any other provision of this title, if the Foundation determines that payments made under any of such sections with respect to any individual are not being used for the purposes for which such payments were made, the Foundation shall certify that fact to the Treasurer of the United States, and the Treasurer of the United States shall thereafter make no further payments under this title with respect to that individual, or (if such failure is the failure of a school) with respect to any individual who is a student or teacher at that school.

"AUTHORIZATION OF APPROPRIATIONS

"SEC. 244. There are authorized to be appropriated, for each fiscal year which begins after the date of the enactment of this title, such sums as may be necessary (1) to enable the Foundation to make the payments provided for in sections 212, 224, 225, 234, and 236 with respect to academic years beginning in that fiscal year, and (2) to pay the costs of administering this title during that fiscal year."

DEPARTMENT OF THE AIR FORCE,
OFFICE OF THE SECRETARY,
Washington, May 12, 1958.

HON. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives.

DEAR MR. CHAIRMAN: I refer to your request to the Secretary of Defense for the views of the Department of Defense with respect to H. R. 2450, a bill to amend the National Science Foundation Act of 1950 to encourage the training of additional engineers and the expansion of facilities for engineering education by providing supplementary salary grants for engineering teachers and scholarships and fellowships for engineering students. The Secretary of Defense has assigned to the Department of the Air Force the responsibility for providing your committee with a report thereon on behalf of the Department of Defense.

The purpose of H. R. 2450 is to assist in providing an adequate supply of trained professional engineers in the United States in order to protect and promote the general welfare and the national defense and security of the United States. To further that purpose the bill would establish the following programs: (1) a system of supplementary salary payments to engineering teachers at approved schools of engineering to bring their total income up to the level of income generally received by engineers of comparable qualifications in private industry; (2) a system of 30 annual scholarship awards in each congressional district to enable exceptionally qualified high-school graduates to pursue college-level courses leading to attainment of a baccalaureate degree in engineering; and (3) a system of fellowships with supplementary salary grants to increase the number of engineering teachers at secondary schools by providing graduates of approved schools of engineering with fellowships for postgraduate study in engineering on condition that they devote a period of time to the teaching of engineering courses in secondary schools. The entire program would be administered by the National Science Foundation with advisory assistance from the Engineers' Council for Professional Development.

Although the Department of the Air Force, on behalf of the Department of Defense, is in sympathy with the purposes of H. R. 2450, it is believed that all aspects of the educational system must be strengthened if substantial improvements are to be made in this country's supply of qualified scientists, engineers and other technical personnel. The Department of Health, Education, and Welfare, which has primary executive department responsibility in this area, has prepared a bill introduced as H. R. 10279, the Educational Development Act of 1958, which represents a comprehensive approach to a solution to the overall problem. A scholarship and fellowship program is included among the provisions of that bill. The Department of Defense has concurred in H. R. 10279 and believes that it would constructively assist in the needed expansion and improvement of educational programs to meet critical national needs.

The Department of the Air Force therefore recommends the enactment of H. R. 10279 in preference to the enactment of H. R. 2450.

This report has been coordinated within the Department of Defense in accordance with procedures prescribed by the Secretary of Defense.

The Bureau of the Budget has advised that there is no objection to the submission of this report.

Sincerely yours,

MALCOLM A. MACINTYRE,
Acting Secretary.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE,
Washington, May 13, 1958.

HON. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

DEAR MR. CHAIRMAN: This letter is in response to your request of January 22, 1957, for a report on H. R. 2450, a bill to amend the National Science Foundation Act of 1950 to encourage the training of additional engineers and the expansion of facilities for engineering education by providing supplementary salary grants for engineering teachers and scholarships and fellowships for engineering students.

This bill would amend the National Science Foundation Act by authorizing the Foundation to (1) provide supplementary salary payments to engineering teachers in approved schools of engineering so as to bring their total income level up to that of engineers of comparable qualifications in private industry; (2) to award 30 scholarships annually in each congressional district to exceptionally qualified high-school graduates to pursue their education in the field of engineering, such awards to consist of payment of the total costs of such education (exclusive of board and room) to the institution selected and $100 per month subsistence allowance to the recipient; (3) to award fellowships to graduates of approved schools of engineering to pursue postgraduate studies in engineering, such fellowships to be conditioned upon an agreement by the recipients to teach engineering courses in secondary schools for a period of time equal to that of the fellowship.

This Department is deeply concerned with the problem of insuring an adequate supply of professionally trained manpower to meet the vital requirements of national security. On January 27, in a special message to the Congress on education, the President proposed a 4-year Federal program designed to stimulate and assist State, local, and private action necessary to meet these educational needs in four critical areas. In the same message he urged that certain activities of the National Science Foundation be increased.

H. R. 10278 and H. R. 10279 (identical bills), now before the House Committee on Education and Labor for consideration, are designed to carry out the President's educational program. H. R. 10278 would authorize Federal assistance to States, institutions of higher education, and individuals to achieve the following purposes: (1) the identification and encouragement of able high-school students, by means of early testing of aptitudes and abilities, improved guidance and counseling techniques and services, and undergraduate scholarships for able high-school graduates; (2) the improvement and expansion of mathematics and science instruction in public secondary schools; (3) expansion and improvement of teaching of modern foreign languages; (4) expansion of programs of graduate education, including fellowships for individuals interested in teaching at institutions of higher education; and (5) improvement in the adequacy and reliability of educational statistics.

The purposes to which the instant bill is addressed are commendable, but we believe that in the end they would be better accomplished by enactment of the provisions of H. R. 10278.

It is the view of the Department that the Nation's requirements for certain professional skills would best be met by increasing the total supply of able manpower from which all professional fields, including that of engineering education, must draw. This view is rather widely shared by scientists and other professionals who are devoting their energies to education in these fields. Accordingly, we believe that Federal scholarships for able high-school graduates should be unrestricted as to the field of study, although, as provided by H. R. 10278, preference in awarding scholarships would be given to students with good preparation in or aptitude for mathematics or science.

For similar reasons, the fellowships provided for under H. R. 10278, while intended primarily for individuals who intend to teach at the college level, would not be restricted as to the field of study.

The programs of the National Science Foundation are making an outstanding contribution to the development of science and engineering in the United States. We believe, however, that these existing programs should be expanded as recommended by the President in his recent message, rather than through enactment of the subject bill.

Our objections to the bill go further. The enactment of this bill would, in our judgment, also present difficult administrative problems. In its provisions for paying the total costs of education, in addition to subsistence allowances for scholarship holders, the bill would revert to the practice followed in the administration of the educational provisions of the Servicemen's Readjustment Act of 1944. This experience proved unsatisfactory and such provision was rejected by the Congress when Public Law 550 (82d Cong.), Veterans' Readjustment Assistance Act of 1952 (Korean GI bill), was enacted.

Accordingly, we recommend that H. R. 2450 not be enacted.

The Bureau of the Budget advises that it perceives no objection to the submission of this report to your committee.

Sincerely yours,

ELLIOT L. RICHARDSON,
Acting Secretary.

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D. C., May 10, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce, House of Representatives, House Office Building, Washington, D. C.

MY DEAR MR. CHAIRMAN: This will acknowledge your letter of January 22, 1957, requesting the views of the Bureau of the Budget on H. R. 2450, a bill to amend the National Science Foundation Act of 1950 to encourage the training of additional engineers and the expansion of facilities for engineering education by providing supplementary salary grants for engineering teachers and scholarships and fellowships for engineering students.

The Bureau of the Budget recognizes the importance of an adequate supply of qualified engineers in furthering the technological advancement of the Nation. However, it has reservations as to the approach contained in this bill.

While salaries of teachers at every level of our educational system are generally inadequate, it is not believed that engineering teachers at the college level should be singled out at this time for Federal supplementary salary aid. The more pressing need is to provide a means for holding and attracting teachers of science and mathematics in the secondary schools where at the present time a serious shortage of numbers and competency exists because of low salaries. The President's education program, introduced as H. R. 10278, recognizes this need by authorizing grants of $150 million annually for 4 years to the States for local school systems to improve science and mathematics education and permits these funds to be used to increase the salaries of science and mathematics teachers. Despite this proposal, efforts to raise the level of teachers' pay continue to be the responsibility of State and local governments and private groups; the proposed Federal program, it is hoped, will further stimulate such efforts.

With respect to the provision for engineering scholarships, it is questionable whether high-school graduates should be induced through a Federal scholarship program to select prematurely a given course of study or professional training. The President's recommended education program (H. R. 10278) provides more appropriately for the award of approximately 10,000 scholarships a year to high-school graduates without limitation as to field of study, although it recognizes the importance of a sound background in science and mathematics by giving preference to those with good preparation in or high aptitude for mathematics or science. The President's program has the additional advantage of relating the scholarship program to a program of testing, counseling, and guidance. It also bases the scholarship stipend on financial need. In view of the substantial increases in projected college enrollments in the next few years, a Federal scholarship program should be primarily directed toward encouraging capable young people who are without sufficient financial resources to enter college.

Regarding the proposed graduate fellowships for engineering students, the Foundation already has authority in the National Science Foundation Act of 1950 to award fellowships in the sciences including engineering. In 1958, with supplemental funds recently appropriated, and in 1959 the graduate fellowship program will be substantially increased over previous levels. It is believed, in the long run, that it is more desirable for the Foundation to continue a broad fellowship program which does not seek to give emphasis to any particular field nor require a commitment to teach as a condition of award. It should be noted, however, that the Foundation program does in fact aid in increasing the number of college teachers as a high proportion of its fellows either continue or enter the teaching profession.

In the light of the above comments, the Bureau does not recommend enactment of H. R. 2450.

Sincerely yours,

PHILLIP S. HUGHES,
Acting Assistant Director for Legislative Reference.

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UNITED STATES CIVIL SERVICE COMMISSION,
Washington, D. C., May 12, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

DEAR MR. HARRIS: Your letters of January 22, 1957, and January 24, 1958, requested us to report on H. R. 2450 and H. R. 10180. H. R. 2450 was introduced by Congressman Holland to amend the National Science Foundation Act to encourage the training of additional engineers and the expansion of facilities for engineering education by providing supplementary salary grants for engineering teachers and scholarships and fellowships for engineering students. H. R. 10180 was introduced by Congressman Sikes to amend the National Science Foundation Act of 1950 to encourage the training of additional engineers and scientists and the expansion of facilities for engineering and science education by providing scholarships and fellowships for engineering and science students.

As the central personnel agency for Government, the Nation's largest employer, we are interested in any practical and effective measures that will alleviate the shortage of scientists and engineers. The substantive provisions of these bills, however, are not within our jurisdiction and we are therefore not commenting in detail. The issues involved in attempting to solve the shortage in the manner proposed by H. R. 2450 and H. R. 10180 are matters of very broad public policy. Such agencies as the National Science Foundation and the Department of Health, Education, and Welfare can advise on these issues more appropriately than can the Civil Service Commission. H. R. 10278 and S. 3163 incorporate administration proposals on this subject.

If legislation of this kind is enacted and the assistance of this Commission in constructing and administering the proposed competitive examination is desired, we shall be glad to provide that assistance to the extent that funds are appropriated for that purpose.

The Bureau of the Budget has advised us that there is no objection to the submission of this report to your committee.

By direction of the Commission:

Sincerely yours,

HARRIS ELLSWORTH, *Chairman.*

NATIONAL SCIENCE FOUNDATION,
Washington, D. C.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

MY DEAR MR. HARRIS: This is in reply to your letter of January 22, 1957, requesting the views of the National Science Foundation with regard to H. R. 2450, proposing amendments to the National Science Foundation Act of 1950 to encourage the training of additional engineers and the expansion of facilities for engineering education by providing supplementary salary grants for engineering teachers and scholarships for engineering students.

The Foundation supports the view that it is important to assure the training of an adequate number of highly competent engineers. However, we must not lose sight of the broader requirements of the Nation. A sufficient number of highly trained persons in many other areas must go hand in hand with our engineering or science skills.

Although the Foundation has broad authority to award scholarships in the mathematical, physical, medical, biological, engineering, and other sciences under the National Science Foundation Act of 1950, we believe that activities in the general area of science teaching and in the support of graduate students should have priority over a scholarship program limited to science or engineering.

This conclusion is based on the fact that the college population has passed its postwar low and has now commenced an upward climb which by 1970 will probably produce a college enrollment at least twice that of today. Engineering enrollments already show substantial increase in proportion to total college enrollments. There are a number of other indications that a high percentage of our capable youth are planning on careers in science and engineering.

While science and technology are exerting an increasing influence on our national life, there are broader considerations which must not be overlooked. Many other fields of scholarship and many professions are facing shortages of highly trained personnel, and each of them requires a share of the limited pool

of highly talented youth. Thus, we favor a noncategorized Federal scholarship program which would not be limited to science and engineering students. A large proportion of the awardees would, we are certain, elect of their own choice to go into science or engineering.

In this connection, as you know, the President has now presented to the Congress a proposed broad program of assistance to education, introduced in H. R. 10278, which includes a general scholarship program providing for approximately 10,000 scholarships annually for 4 years, with preference to be given students with good preparation in, or aptitude for, mathematics or science.

Pursuant to authority contained in the National Science Foundation Act of 1950, the Foundation is condutcing a science fellowship program which includes awards for predoctoral and postdoctoral study and awards to college science faculty members for study away from their teaching responsibilities. In addition, the President's budget for fiscal 1959 has included funds for the Foundation for initiation of a summer fellowship program for high-school science and mathematics teachers, a summer study program for college teaching assistants, a preservice teacher training program, and a program of training grants for graduate students.

The Foundation is also supporting various summer institute programs for high-school and college teachers and academic year programs for high-school teachers. Furthermore, the Foundation grants program in support for basic research is affording the opportunity of research training to a large number of young scientists and engineers.

As you can see, the Foundation is actively engaged in programs designed to help solve the problems with which H. R. 2450 is concerned.

The matter of teachers' salaries in general is a serious one, although engineering teachers' salaries do not appear to present a more acute problem than those of other science teachers. At the elementary and high-school levels teachers' salaries are a matter of particular concern. There is a large loss of competent high-school teachers of science and mathematics each year through the attraction of more lucrative opportunities elsewhere. The President's program in support of education contained in H. R. 10278 recognizes the importance of this problem by providing that $150 million of the funds authorized could be used for grants to the States for improvement of science education by local school systems and permits the utilization of these funds to supplement or increase the salaries of secondary-school teachers of science and mathematics. This problem is, however, a broad one which should primarily be solved by State and local governments in cooperation with private groups. It is hoped that the proposed Federal program will stimulate efforts in this direction.

We greatly appreciate your interest in this problem and the opportunity to give you our views on this bill.

The Bureau of the Budget has advised us it has no objection to the submission of this report.

Sincerely yours,

ALAN T. WATERMAN,
Director.

[H. R. 9918, 85th Cong., 2d sess.]

A BILL To establish a Federal program of financial assistance to students in certain fields of science

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it is the purpose of this Act to encourage individuals who have unusual abilities in the fields of science referred to in section 3 of this Act to pursue courses of study leading toward a baccalaureate or graduate degree in such fields of science by providing for a program of financial assistance through the payment of tuition and monthly stipends of $75 per month with respect to individuals selected by the National Science Foundation solely on the basis of ability as established by competitive examinations, who will pursue such courses of study at institutions of higher education in the United States and maintain minimum academic standards prescribed by such Foundation.

SEC. 2. As used in this Act—

(1) the term "institution of higher education" means any college, university, or similar institution which offers a course of instruction extending at least two academic years beyond the high school; and

(2) the term "United States", when used in a geographical sense, includes the several States, Territories, and possessions of the United States, the Commonwealth of Puerto Rico, and the District of Columbia.

SEC. 3. (a) The National Science Foundation shall conduct annual examinations throughout the United States for the purpose of determining which citizens of the United States who have completed at least their high school education or the equivalent thereof, as determined by the Foundation, possess unusual abilities in the field of physics, chemistry, mathematics, or such other fields of the physical sciences as the Foundation may designate as a field of science with respect to which financial assistance may be granted under this Act.

(b) The specific times, places, and manner of holding such examinations shall be prescribed by the National Science Foundation.

SEC. 4. (a) The National Science Foundation shall pay to each individual selected by it, from among those who participate in the examinations referred to in section 3 of this Act—

(1) an amount equal to the regular tuition and related charges for which such individual is liable with respect to the course of study he is pursuing, not to exceed $2,000 in any calendar year; and

(2) the sum of $75 per month for each month during any part of which such individual is actually in attendance at an institution of higher education in the United States selected by such individual and approved by the Foundation, and pursuing courses of study leading toward a baccalaureate or graduate degree in the field of science for which he was selected by the Foundation, to help defray his living expenses (including meals, lodging, fees, charges, books, supplies, equipment, and other items which are necessary to his education but which are not made available to him without charge by such institution, and are not included in the regular tuition and related charges referred to in paragraph (1)).

(b) No individual shall continue to receive the payments referred to in subsection (a) of this section unless—

(1) he maintains minimum academic standards prescribed by the National Science Foundation; and

(2) he continues to pursue courses of study in the field of science for which he was selected by the Foundation.

SEC. 5. Funds appropriated, after the date of enactment of this Act, to carry out the purposes of chapter 1 of title I of the Mutual Security Act of 1954 shall be available for expenditure by the National Science Foundation in such amounts as the National Science Foundation may from time to time certify as necessary to carry out the purposes of this Act.

SEC. 6. Nothing in this Act shall be construed to authorize any department, agency, officer, or employee of the United States to exercise any direction, supervision, or control over the curriculum or program of instruction of any institution of higher education or over its administration or personnel.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE,
Washington, May 13, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

DEAR MR. CHAIRMAN: This letter is in response to your request of January 20, 1958, for a report on H. R. 9918, a bill to establish a Federal program of financial assistance to students in certain fields of science.

This bill would authorize the National Science Foundation to conduct annual examinations throughout the United States for the purpose of selecting high-school graduates who possess unusual abilities in the fields of mathematics and the physical sciences who would receive financial assistance while attending an institution of higher education and pursuing courses of study leading to a baccalaureate or graduate degree in the field of science for which he was selected by the Foundation. The Foundation would be authorized to pay to individuals selected by it an amount equal to the tuition and related charges with respect to such course of study, but not to exceed $2,000 in any calendar year, and $75 per month for each month the individual is in actual attendance at an institution of higher education.

This Department is deeply concerned with the problem of expanding the quantity and quality of educational opportunity to meet the defense and other vital needs of the Nation. On January 27, 1958, in a special message on education,

the President recommended that the Congress authorize a 4-year Federal program designed to stimulate and assist State, local, and private action necessary to meet these needs in certain critical fields of education. H. R. 10278 (and the identical bill H. R. 10279), now before the House Committee on Education and Labor for consideration, is designed to carry out these recommendations.

One of the authorizations contained in H. R. 10278 is for a program of Federal scholarships for able high-school graduates who need financial assistance to continue their education, combined with Federal assistance to States and institutions of higher learning to encourage the early identification of able students and the development of adequate counseling and guidance services. This program would provide for approximately 10,000 new scholarships each year for a 4-year period.

The purposes to which the instant bill is addressed and commendable, but we believe that in the end they would be better accomplished by enactment of the provisions of H. R. 10278.

It is the view of the Department that the Nation's requirements for certain professional skills would best be met by increasing the total supply of able manpower from which all professional fields, including those provided for in the bill, must draw. This view is rather widely shared by scientists and other professionals who are devoting their energies to education in these fields. Accordingly, we believe that Federal scholarships for able high-school graduates should be unrestricted as to the field of study, although, as provided by H. R. 10278, preference in awarding scholarships would be given to students with good preparation in or aptitude for mathematics of science.

The programs of the National Science Foundation are making an outstanding contribution to the development of science and engineering in the United States. We believe, however, that these existing programs should be expanded as recommended by the President in his recent message, rather than through enactment of the subject bill.

Accordingly, we recommend that H. R. 9918 not be enacted.

The Bureau of the Budget advises that it perceives no objection to the submission of this report to your committee.

Sincerely yours,

ELLIOT L. RICHARDSON,
Acting Secretary.

NATIONAL SCIENCE FOUNDATION,
Washington, D. C.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

MY DEAR MR. HARRIS: This is in response to your letters of January 20 and 24, 1958, requesting the comments of the National Science Foundation with regard to H. R. 9918, a bill to establish a Federal program of financial assistance to students in certain fields of science, and with regard to H. R. 10180, a bill to amend the National Science Foundation Act of 1950 to encourage the training of additional engineers and scientists and the expansion of facilities for engineering and science education by providing scholarships and fellowships for engineering and science students. Since both bills are concerned with similar matters, we feel that our comments with regard to both of them can be combined in a single letter. As you know, one of the Foundation's prime concerns is that the Nation have an adequate supply of highly competent scientists and engineers. While we have broad authority to award scholarships in the mathematical, physical, medical, biological, engineering and other sciences under the National Science Foundation Act of 1950, we believe that activities in the general area of science teaching and in the support of graduate students should have priority over a scholarship program limited to science and engineering.

This conclusion is based on the fact that the college population has passed its postwar low and has now commenced an upward climb which by 1970 will probably produce a college enrollment at least twice that of today. Engineering enrollments already show substantial increase in proportion to total college enrollments. There are a number of other indications that a high percentage of our capable youth are planning on careers in science and engineering.

While science and technology are exerting an increasing influence on our national life, there are broader considerations which must not be overlooked. Many other fields of scholarship and many professions are facing shortages of highly trained personnel, and each of them requires a share of the limited pool

of highly talented youth. Thus, we favor a noncategorized Federal scholarship program which would not be limited to science and engineering students. A large proportion of the awardees would, we are certain, elect of their own choice to go into science or engineering.

In this connection, as you know, the administration has now presented to the Congress a proposed broad program of assistance to education which includes a general scholarship program providing for approximately 10,000 scholarships annually for 4 years. We believe that enactment of such legislation would be in the national interest.

We appreciate the opportunity to comment on the proposed legislation.

The Bureau of the Budget has advised us it has no objection to the submission of this report.

Sincerely yours,

ALAN T. WATERMAN, *Director.*

DEPARTMENT OF STATE,
Washington, May 14, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives.

DEAR MR. HARRIS: This letter supplements my acknowledgement of January 24, 1958, of your request of January 22 for the Department's views on the bill H. R. 9918, to establish a Federal program of financial assistance to students in certain fields of science.

The Department believes that assistance should be extended to worthy students, including those in scientific fields. It feels, however, that legislation for this purpose should not categorize recipients, as H. R. 9918 appears to do, but should be cast in terms of a noncategorical program.

Section 5 of the bill proposes that funds appropriated to carry out the purposes of chapter 1 of title I of the Mutual Security Act of 1954 shall be available for this scholarship program. These funds are appropriated by the Congress for the express purpose of assisting other free world nations to strengthen their military defenses in the interests of our collective security. The amount of funds so appropriated is based on estimates of requirements for military assistance in the coming fiscal year necessary to maintain our collective security position. Use of these funds for the purpose envisaged in the bill would, therefore, appear wholly inappropriate and would be counter to the express purpose of the Congress in appropriating these funds.

The Department believes that S. 3163, the Educational Development Act of 1958, in which financial assistance is open to students in fields of learning beyond the natural sciences, coupled with the expanded program of the National Science Foundation for aid in scientific fields, complement each other in providing a more balanced effort for coping with the problem of educational progress.

The Department has been informed by the Bureau of the Budget that there is no objection to the submission of this report.

Sincerely yours,

WILLIAM B. MACOMBER, Jr.,
Assistant Secretary
(For the Secretary of State).

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D. C., May 10, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, House Office Building, Washington, D. C.

MY DEAR MR. CHAIRMAN: This will acknowledge your request for the views of the Bureau of the Budget on H. R. 9918, a bill to establish a Federal program of financial assistance to students in certain fields of science.

H. R. 9918 would authorize the National Science Foundation to award scholarships and fellowships in the physical sciences and mathematics including payments for tuition and related charges up to $2,000 a year and monthly stipend payments of $75 to help defray living expenses. The bill would authorize the Foundation to use for this purpose funds appropriated to carry out the provisions of chapter 1 of title I of the Mutual Security Act of 1954.

It would appear that the authorization for scholarships, fellowships, and related expenses under H. R. 9918 is not necessary inasmuch as it would duplicate authority vested in the Foundation by the National Science Foundation Act of 1950. Since its establishment, the Foundation has had a fellowship program for graduate study in mathematics and the sciences. It has not, however, initiated a scholarship program in the belief that federally financed scholarships should not be limited to the sciences. In this regard, the President's education program (H. R. 10278 or H. R. 10279) would authorize a general scholarship program providing for approximately 10,000 scholarships annually for 4 years, coupled with grants for testing, counseling, and guidance services in schools.

With reference to the use of mutual security funds, the funds appropriated for chapter 1 of title I of the Mutual Security Act of 1954 are solely for the purpose of military assistance and it is considered inappropriate for such funds to be used by the Foundation for scholarships or fellowships.

Accordingly, the Bureau recommends against enactment of H. R. 9918 and recommends instead enactment of H. R. 10278 or H. R. 10279.

Sincerely yours,

PHILLIP S. HUGHES,
Acting Assistant Director for Legislative Reference.

[H. R. 10180, 85th Cong., 2d sess.]

A BILL To amend the National Science Foundation Act of 1950 to encourage the training of additional engineers and scientists and the expansion of facilities for engineering and science education by providing scholarships and fellowships for engineering and science students

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That (a) the National Science Foundation Act of 1950 is amended by striking out the first section and inserting in lieu thereof the following:

"TITLE I

"SHORT TITLE

"SECTION 1. This Act may be cited as the 'National Science Foundation Act of 1950'."

(b) Section 3 (c) of such Act is amended by inserting "under this title" after "activities of the Foundation".

(c Sections 3, 4, 5, 6, 11, 12, 13, 14, 15, and 16 of such Act are amended by striking out "this Act" wherever it appears and inserting in lieu thereof "this title".

(d) Section 16 (a) of such Act is amended by inserting "under this title" after "powers and duties".

SEC. 2. The National Science Foundation Act of 1950 is further amended by adding at the end thereof the following new title:

"TITLE II

"PART A—DECLARATION OF POLICY AND DEFINITIONS

"DECLARATION OF POLICY

"SEC. 201. It is the policy of the Congress and the purpose of this title to assist in providing an adequate supply of trained professional engineers and scientists in the United States, and thereby to protect and promote the general welfare and the national defense and security of the United States.

"DEFINITIONS

"SEC. 202. As used in this title—

"(1) the terms 'engineering course' and 'science course' include any course or group of courses (regardless of whether given at the secondary, undergraduate, or postgraduate level) which is determined by the Foundation to be (A) within any field of engineering and science, (B) a prerequisite of an adequate engineering or science education, or (C) necessarily related to an adequate engineering or science education;

"(2) the term 'approved school of engineering or science' means an educational institution in the United States which (A) admits as regular undergraduate students only students having at least a secondary educa-

tion or its recognized equivalent, (B) offers and conducts an educational program of at least four academic years leading to a baccalaureate degree in engineering or science (whether or not it also offers a postgraduate educational program in engineering or science), and (C) is approved by the Foundation as meeting all the standards for accreditation;

"(4) the term 'United States', when used in a geographical sense, means the several States, Alaska, Hawaii, the Commonwealth of Puerto Rico, and the District of Columbia; and

"(5) the term 'congressional district', at any given time, means a congressional election district as established pursuant to the most recent reapportionment of Representatives under section 22 of the Act of June 18, 1929 (2 U. S. C. 2a), and includes the Territory of Alaska, the Territory of Hawaii, and the Commonwealth of Puerto Rico.

"PART B—SCHOLARSHIPS

"STATEMENT OF PURPOSE

"SEC. 221. It is the purpose of this part to encourage exceptionally qualified high school graduates with special interest and ability in the field of engineering and science to pursue their education in such field at the college level, by awarding them scholarships to pay the expenses incident to the attainment of a baccalaureate degree in engineering or science.

"AWARD OF SCHOLARSHIPS

"SEC. 222. (a) The Foundation shall provide for the holding of annual competitive examinations in each congressional district to determine the individuals who will be awarded scholarships from that district under this part. The specific time, place, and manner of holding each such examination shall be prescribed by the Foundation. Such examinations shall be held sufficiently early in each year (beginning with the calendar year 1958) to permit the participants who are awarded scholarships to begin their education under such scholarships at the fall term in such year.

"(b) Individuals desiring to compete in such examinations shall make written application therefor in such manner and form (subject to subsection (c)) as the Foundation shall prescribe. The Foundation shall prescribe regulations setting forth the minimum qualifications for participation in such examinations, including requirements with respect to the engineering and science courses which an applicant must have completed at the secondary school level and the scholastic grade average which he must have maintained at that level. No individual shall be eligible to compete in any such examination unless he will have completed his secondary education (or the recognized equivalent thereof) in time to begin his education under a scholarship at the fall term in the year in which the examination is held. No individual shall be eligible to compete in any such examination unless he is a resident of the congressional district in which it is held and either is a citizen of the United States or an alien lawfully admitted to the United States for permanent residence.

"(c) Each application to compete in an examination under this section shall be initially submitted by the applicant to the Representative in Congress, Delegate, or Resident Commissioner representing the congressional district in which he resides, and shall be forwarded by such Representative, Delegate, or Resident Commissioner, together with a certification as to whether or not the applicant actually resides in such district, to the Foundation.

"(d) Twenty-five scholarships (or, if less than twenty-five of the participants in any competitive examination attain the minimum qualifying grade as determined by the Foundation, a number of scholarships equal to the number of participants who attained such grade in the examination) shall be awarded in order of merit each year to individuals from each congressional district.

"(e) As soon as practicable after the completion of such competitive examinations in each year, the Foundation shall notify each Representative in Congress, and each Delegate and the Resident Commissioner, of the names of the individuals eligible to be awarded scholarships from his congressional district as a result of such examinations.

"(f) (1) In the event that less than twenty-five scholarships are awarded in any year under subsection (d) to individuals from any congressional district, the scholarships not so awarded in that district shall be awarded by the Foundation, in time to permit the recipients thereof to begin their education there-

under at the fall term in such year, to individuals from other congressional districts who participated in the competitive examinations for such year and attained the minimum qualifying grade as determined by the Foundation but were not awarded scholarships. The individuals awarded scholarships under this paragraph shall be selected on the basis of their performance in the examinations and such other factors (including the desirability of the widest possible geographical distribution of scholarships under this part) as the Foundation may consider appropriate.

"(2) Any scholarships which are initially available in any year as provided in subsection (d), but which are not awarded either under subsection (d), or under paragraph (1) of this subsection, shall be awarded, under regulations to be prescribed by the Foundation, to individuals already attending approved schools of engineering or science who are in the upper 10 per centum of their classes at such schools and who will continue under such scholarships to pursue their engineering or science courses.

"(g) An individual awarded a scholarship under this part shall not be eligible, while attending an approved school of engineering or science under such scholarship, to receive any education, training, or other benefits under part VII or VIII of Veterans Regulation Numbered 1 (a) or title II of the Veterans' Readjustment Assistance Act of 1952.

"SELECTION OF SCHOOL

"SEC. 223. An individual awarded a scholarship under this part may pursue his engineering or science course under such scholarship at any approved school of engineering or science in the United States which agrees to admit him and to accept the payments made on his behalf under section 224 in lieu of the tuition and other charges customarily imposed.

"PAYMENTS TO APPROVED SCHOOLS OF ENGINEERING OR SCIENCE

"SEC. 224. (a) The Foundation shall pay to each approved school of engineering or science with respect to each student attending such school under a scholarship awarded under this part, an amount equal to the actual cost to such school (as determined by the Foundation without regard to the school's other income and resources) of educating such student and providing facilities (other than meals and lodging) in connection therewith. Such payment shall be in lieu of the tuition and other charges (except charges for meals and lodging) imposed generally on students at such school.

"(b) Payment to an approved school of engineering or science under subsection (a) with respect to any student shall be made only for the period of such student's entitlement under his scholarship as determined under section 226, and within such period shall be made at such times and in such manner as the Foundation shall prescribe.

"DIRECT PAYMENTS TO SCHOLARSHIP HOLDERS

"SEC. 225. (a) The Foundation shall pay directly to each individual who holds a scholarship awarded under this part an allowance of $100 a month, for each month during any part of which he is actually attending school under such scholarship, to pay the living expenses of such individual (including his meals and lodging and any supplies, books, equipment, and other items which are reasonably necessary to his engineering or science education and which are not made available to him without charge by the school).

"(b) Payment to any individual of an allowance under subsection (a) shall be made only for the period of such individual's entitlement under his scholarship as determined under section 226, and within such period shall be made at such times and in such manner as the Foundation shall prescribe.

"PERIOD OF ENTITLEMENT UNDER SCHOLARSHIPS

"SEC. 226. (a) Except as provided in subsection (b), the period of entitlement of any individual under a scholarship awarded under this part shall extend from the first day of the month in which he begins to pursue his engineering or science course under such scholarship at an approved school of engineering or science to the last day of the month in which he receives his first post-secondary-school degree from such school.

"(b) (1) An individual's period of entitlement under a scholarship awarded under this part shall immediately terminate if he ceases to pursue his engineering

or science course in continuous attendance at the school which he selected under section 223, or if he ceases to meet any of the academic, disciplinary, and other standards applicable to students generally at such school; but an individual's period of entitlement shall not be terminated by his absence from the school during a regular summer vacation or by a leave of absence of not more than twelve months duly granted by the school.

"(2) The Foundation may require, as a condition of any payments under sections 224 and 225 with respect to an individual awarded a scholarship under this part, that the individual and the approved school of engineering or science which he is attending submit such reports and furnish such information concerning the individual's academic progress, the use of amounts paid under such sections, and any related matters, as the Foundation may request.

"PART C—GRADUATE FELLOWSHIPS

"STATEMENT OF PURPOSE

"SEC. 231. It is the purpose of this part to increase the number of engineering or science teachers at secondary schools, while encouraging graduates of approved schools of engineering or science to pursue postgraduate engineering or science courses, by awarding fellowships to such graduates on condition that they devote a period of time to the teaching of engineering courses in secondary schools.

"AWARD OF FELLOWSHIPS

"SEC. 232. Any individual holding a baccalaureate degree in engineering or science from an approved school of engineering or science, if he enters into the agreement described in section 233 and makes application under this part within such time and in such manner and form as the Foundation shall prescribe, may be awarded a three-year graduate fellowship by the Foundation as provided in this part. Such fellowship shall be used by the holder thereof only for the purpose of acquiring one or more postgraduate degrees in engineering or science at an approved school of engineering or science and shall not become effective until the completion by the holder of the performance of his obligations under such agreement.

"AGREEMENTS BY FELLOW APPLICANTS

"SEC. 233. (a) Before a graduate fellowship may be awarded to any individual under this part, such individual shall enter into a written agreement with the Foundation promising that he will serve for a period of three academic years as an engineering or science teacher at a duly accredited secondary school in the United States, beginning as soon after graduation with a baccalaureate or higher degree as he is able to secure a position as a teacher at such a school (and in any event within such period as the Foundation shall designate).

"(b) The Foundation shall assist any individual awarded a fellowship under this part, upon the request of such individual, in securing a position as a teacher of engineering or science courses at a duly accredited secondary school in the United States.

"(c) The involuntary termination of an individual's service as a teacher of engineering or science courses at any secondary school, not due to incompetence or misconduct on his part, shall not constitute a failure to perform his obligations under the agreement or an interruption of the performance of such obligations if he proceeds without delay to seek a similar position at another such secondary school and secures such a position within a period to be prescribed by the Foundation. The absence of such individual from his teaching duties during a regular summer vacation, or during a leave of absence duly granted by the school, shall not constitute an interruption of the performance of such obligations. Any other termination of such an individual's service as a teacher of engineering or science courses at a secondary school, and any other failure by such an individual continuously to perform his teaching duties at such school, shall constitute a failure by such individual to perform his obligations under such agreement, and shall render him liable for repayment to the Foundation of all or part of the funds advanced for his education as determined by the Foundation.

"SELECTION OF SCHOOL

"SEC. 234. An individual who has been awarded a fellowship under this part, and who has completed the performance of his obligations under the agreement described in section 233, may pursue his postgraduate engineering or science

course under such fellowship at any approved school of engineering or science in the United States which agrees to admit him as a candidate for one or more postgraduate degrees in engineering or science and to accept the payments made on his behalf under section 235 (a) in lieu of the tuition and other charges customarily imposed.

"PAYMENTS UNDER FELLOWSHIPS

"SEC. 235. (a) The Foundation shall pay directly to any approved school of engineering or science, on behalf of each individual pursuing a postgraduate engineering or science course at such school under a fellowship awarded under this part, an amount equal to the actual cost to such school (as determined by the Foundation without regard to the school's other income and resources) of educating such individual and providing facilities (other than meals and lodging) in connection therewith. Such payment shall be in lieu of the tuition and other charges (except charges for meals and lodging) imposed generally on individuals pursuing such courses at such school. Such payment shall be made with respect to any holder of a fellowship only for the period of his entitlement thereunder as determined under section 236, and within such period shall be made at the times and in the manner prescribed by the Foundation.

"(b) The Foundation shall pay directly to each individual pursuing a postgraduate engineering or science course at an approved school of engineering or science under a fellowship awarded under this part, throughout the period of his entitlement under the fellowship as determined under section 236, an amount of $200 per month (as living expenses).

"PERIOD OF ENTITLEMENT UNDER FELLOWSHIPS

"SEC. 236. (a) Except as provided in subsection (b) the period of entitlement of any individual under a fellowship awarded under this part shall extend from the first day of the month in which (after completing the performance of such obligations he begins to pursue his postgraduate engineering or science course under such fellowship at an approved school of engineering or science to the last day of the month in which he receives his higher degree or degrees in engineering or science from such school.

"(b) (1) No individual's period of entitlement under a fellowship awarded under this part shall be more than three calendar years; and any such period shall immediately terminate if the individual ceases to pursue a postgraduate engineering or science course, in continuous attendance at the school which he selected under section 234, which will lead to a master's degree or a doctorate in engineering or science, or if he ceases to meet any of the academic, disciplinary, and other standards applicable to postgraduate students at such school. An individual's period of entitlement shall not be terminated by his absence from the school during a regular summer vacation or by a leave of absence of not more than twelve months duly granted by the school; and any such leave of absence shall be excluded in the computation of the three-year period referred to in the preceding sentence.

"(2) The Foundation may require, as a condition of any payments under section 236 with respect to an individual awarded a fellowship under this part, that the individual and the approved school of engineering or science which he is attending submit such reports and furnish such information concerning the individual's academic progress, and related matters, as the Foundation may consider necessary for the purpose of this part.

"PART D—GENERAL PROVISIONS

"FEDERAL CONTROL OF EDUCATION PROHIBITED

"SEC. 241. Nothing contained in this title shall be construed as authorizing any department, agency, officer, or employee of the United States to exercise any direction, supervision, or control over the curriculum or program of instruction of any educational institution or over its administration or personnel.

"ADMINISTRATION

"SEC. 242. (a) The Director of the Foundation, in accordance with policies established by the National Science Board, shall exercise the powers and duties vested in the Foundation by this title.

"(b) The Foundation shall make regular studies and investigations of the programs established by this title, and shall make a full report to the Congress at

the beginning each regular session thereof with respect to the administration of each of such programs, including the recommendations of the Foundation for needed revisions in such programs.

"(c) In the administration of this title, the Foundation shall have the authority and powers provided in sections 11 and 14 of this Act to the extent that such authority and powers are determined by the Foundation to be necessary or appropriate for the purpose of this title.

"(d) Scholarship awarded under part C of this title and graduate fellowships awarded under part D of this title shall be in addition to any scholarships and graduate fellowships awarded under section 10 of this Act.

"PAYMENTS TO INDIVIDUALS AND SCHOOLS

"SEC. 243. (a) Any payment provided for by sections 224, 225, and 235 shall be made by the Treasurer of the United States upon the certification of the Foundation.

"(b) Notwithstanding any other provision of this title, if the Foundation determines that payments made under any of such sections with respect to any individual are not being used for the purposes for which such payments were made, the Foundation shall certify that fact to the Treasurer of the United States, and the Treasurer of the United States shall thereafter make no further payments under this title with respect to that individual, or (if such failure is the failure of a school) with respect to any individual who is a student or teacher at that school.

"AUTHORIZATION OF APPROPRIATIONS

"SEC. 244. There are authorized to be appropriated, for each fiscal year which begins after the date of the enactment of this title, such sums as may be necessary (1) to enable the Foundation to make the payments provided for in sections 224, 225, and 235 with respect to academic years beginning in that fiscal year, and (2) to pay the costs of administering this title during that fiscal year."

DEPARTMENT OF THE AIR FORCE,
Washington, May 12, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives.

DEAR MR. CHAIRMAN: I refer to your request to the Secretary of Defense for the views of the Department of Defense on H. R. 10180, 85th Congress, a bill to amend the National Science Foundation Act of 1950 to encourage the training of additional engineers and scientists and the expansion of facilities for engineering and science education by providing scholarships and fellowships for engineering and science students. The Secretary of Defense has delegated to this Department the responsibility for expressing the views of the Department of Defense thereon.

The purpose of H. R. 10180 is as stated in its title. Under the bill the National Science Foundation would administer yearly competitive examinations within each congressional district for the purpose of awarding 25 scholarships annually to qualifying students within each district. Students awarded such scholarships would receive an allowance of $100 per month for each month of attendance, in addition to the payment by the Government to the schools of the tuition and other charges customarily imposed. In addition, the bill would authorize the National Science Foundation to award 3-year graduate fellowships to be used by the holders thereof to acquire one or more postgraduate degrees in engineering or science. Students accepting fellowships would have to agree to serve for a period of 3 academic years as an engineering or science teacher at a duly accredited secondary school in the United States.

Although the Department of the Air Force, on behalf of the Department of Defense, is in sympathy with the purposes of H. R. 10180, it is believed that all aspects of the educational system must be strengthened if substantial improvements are to be made in this country's supply of qualified scientists, engineers and other technical personnel. The Department of Health, Education, and Welfare, which has primary executive department responsibility in this area, has prepared a bill introduced as H. R. 10279, Educational Development Act of 1958, which represents a comprehensive approach to a solution to the overall

problem. A scholarship and fellowship program is included among the provisions of that bill. The Department of Defense has concurred in H. R. 10279 and believes that it would constructively assist in the needed expansion and improvement of educational programs to meet critical national needs.

The Department of the Air Force therefore recommends the enactment of H. R. 10279 in preference to the enactment of H. R. 10180.

This report has been coordinated within the Department of Defense in accordance with procedures prescribed by the Secretary of Defense.

The Bureau of the Budget advises that there is no objection to the submission of this report.

Sincerely yours,

MALCOLM A. MACINTYRE,
Acting Secretary.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE,
Washington, May 13, 1985.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

DEAR MR. CHAIRMAN: This letter is in response to your request of January 24, 1958, for a report on H. R. 10180, a bill to amend the National Science Foundation Act of 1950 to encourage the training of additional engineers and scientists and the expansion of facilities for engineering and science education by providing scholarships and fellowships for engineering and science students.

This bill would authorize the National Science Foundation to award undergraduate scholarships to 25 eligible applicants in each of the congressional districts, on the basis of successful completion of a competitive examination given by the Foundation, for study in the fields of engineering or science at any approved school of engineering or science in the United States. Payment would be made to the school of the actual cost to such school of educating the scholarship recipient. Each scholarship recipient would be paid $100 per month for each month in actual attendance to pay his living and incidental educational expenses. The period of entitlement would be for the time normally required to receive the first post-secondary-school degree.

The bill would also authorize the Foundation to award fellowships for graduate study in the fields of engineering and science to holders of the baccalaureate degree in engineering or science who would agree in writing to teach for a period of 3 academic years in an accredited secondary school. The fellowship would be for 3 academic years, and would provide for payment to the institution of the actual cost of educating the recipient and for payment to the fellowship recipient of a stipend in the amount of $200 per month during the period of entitlement.

This Department is deeply concerned with the problem of expanding the quality and quantity of educational opportunity to meet the defense and other vital needs of the Nation. The President has recommended that the Congress authorize a 4-year Federal program to stimulate and assist State, local, and private action necessary to overcome certain educational deficiencies which threaten the national security. H. R. 10278 (also H. R. 10279), now before the House Committee on Education and Labor for consideration, is designed to carry out these recommendations.

One of the authorizations contained in H. R. 10278 is for a program of Federal scholarships for able high school graduates who need financial assistance to continue their education, combined with Federal assistance to States and institutions of higher learning to encourage the early identification of able students and the development of adequate counseling and guidance services. The funds authorized by the bill would provide approximately 10,000 new scholarships each year for a 4-year period.

The basic objective of this proposal is to help reduce the Nation's waste of human talent which occurs through the failure of able students to continue their education beyond high school. Assistance to States to provide for the early identification of the able youth and for the expansion and improvement of guidance and counseling services will do much to achieve this objective. The further provision for scholarships is viewed as an integral part of this program and is designed to encourage able high school graduates who, having been identified and properly counseled in their earlier school years, need financial assistance to continue their education. The purpose of these provisions is to encourage able students to work hard at the basic academic courses needed for college and to stimulate increased State, local, and private action to prevent this loss of talent.

The National Science Foundation Act of 1950, as amended, authorizes the Foundation to grant undergraduate scholarships for study in the sciences leading to the first post-secondary-school degree. This authority, as a matter of policy has never been exercised because of the belief that it would not be in the national interest to grant undergraduate scholarships restricted as to the field of study. We fully endorse this conclusion and strongly oppose the scholarship provision contained in the instant bill, H. R. 10180. It is our view—a view widely shared by scientists and engineers who are devoting their energies to education in these fields—that real benefit to the fields of science, engineering, and mathematics is more likely to flow from a program for improved testing, guidance, and counseling in our high schools which, when coupled with a noncategorical scholarships program, will encourage and help greater numbers of talented young people to continue into higher education. Scholarships awarded without restriction as to the field of study, but with preference given in the selection of recipients to those with a good preparation in or high aptitude for mathematics or science, as provided in H. R. 10278, would assure that an adequate proportion of the recipients would pursue studies in engineering, mathematics, and science.

Furthermore, high school seniors are seldom in a position to make a definite career commitment. Substantial scholarships available only for study in science, engineering, or mathematics would tend to draw into those fields able students whose strongest aptitudes or dominant interests lie in other directions. Of this group, some would belatedly find their proper niches; others would become misfits. The result would be wasteful both to them and to the institutions which expend effort on training them.

Our objections to the scholarship provision in the instant bill go further, however. We believe that a Federal scholarship program should be administered by the States and should be closely tied to State and local programs for the early identification of student aptitudes and abilities and for improved counseling and guidance services, as would be provided by H. R. 10278. Moreover, the amount of scholarship awards should reflect the financial need of recipients.

The provision of the instant bill for assisting graduates of institutions of higher learning to continue work toward a graduate degree in science and engineering is, in our opinion, unnecessary in view of the existing authority of the National Science Foundation to award fellowships in these fields. Further, the provision for making such fellowship awards contingent upon an agreement of the recipient to teach in a secondary school would be unwise. The most critical need for teachers with advanced degrees at this time is in the colleges and universities. We therefore prefer the fellowship provision set forth in title IV of H. R. 10278, which would give preference to individuals interested in teaching in institutions of higher education and would be an integral part of a Federal program to assist such institutions to expand their programs of graduate education.

For these reasons, we recommend that H. R. 10278 be enacted rather than H. R. 10180.

The Bureau of the Budget advises that it perceives no objection to the submission of this report to your committee.

Sincerely yours,

ELLIOT L. RICHARDSON,
Acting Secretary.

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D. C., May 10, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representative, House Office Building, Washington, D. C.

MY DEAR MR. CHAIRMAN: This will acknowledge your letter of January 24, 1958, requesting the views of the Bureau of the Budget on H. R. 10180, a bill to amend the National Science Foundation Act of 1950 to encourage the training of additional engineers and scientists and the expansion of facilities for engineering and science education by providing scholarships and fellowships for engineering and science students.

H. R. 10180 would authorize the National Science Foundation to award scholarships for study in engineering and the sciences. The bill would also authorize the Foundation to award graduate fellowships in engineering or the sciences with the requirement that such fellows agree to serve a period of 3 years as teachers of science or engineering courses in high schools.

Under the National Science Foundation Act of 1950, the Foundation is authorized to award both scholarships and fellowships in the sciences and engineering. Since its establishment the Foundation has provided fellowships for graduate education. However, it has not inaugurated a scholarship program in the belief that Federal scholarships should not be limited to any particular field of study.

The proposed education program of the President in H. R. 10278 and H. R. 10279, identical bills, provides for an award of approximately 10,000 new scholarships annually for 4 years These scholarships would be awarded without regard to field of study.

While the present fellowship program of the National Science Foundation does not require any teaching commitment, nevertheless a substantial portion of those awarded fellowships by the Foundation do undertake teaching careers, generally at the college level. It is not believed appropriate for a Federal program to require teaching either at the high-school or college level, inasmuch as the most productive use of one's educational experience comes from free choice of work environment.

In view of the authority now vested in the National Science Foundation and the proposed scholarship program of the administration, the Bureau does not recommend enactment of H. R. 10180, and recommends instead enactment of H. R. 10278 or H. R. 10279.

Sincerely yours,

PHILLIP S. HUGHES,
Acting Assistant Director for Legislative Reference.

[H. R. 4218, 85th Cong., 1st sess.]

A BILL To amend the National Science Foundation Act of 1950 to provide scholarships

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Science Foundation Act of 1950 is hereby amended by redesignating the present section 10 as subsection 10 (a) and by adding a new subsection (b) as follows:

"(b) The Foundation is authorized to award, within the limits of funds made available specifically for such purpose pursuant to section 16 of this Act, scholarships of $500 each for the successful completion of an examination in high school mathematics. The examination shall test the general knowledge of mathematics of those about to matriculate into college. In addition the Foundation is authorized to award, within the limits of funds made available specifically for such purpose pursuant to section 16 of this Act, further scholarships of $500 each to be given to those persons who, having received a scholarship under this subsection at the time of matriculation into college, successfully complete an examination in calculus at the end of the first year of college. In giving the examinations required under this subsection the Foundation is authorized to make use of the services of persons normally engaged in giving nationwide examinations at the college entrance or college level, and may enter into contracts with such persons for their services, without regard to the provisions of section 3709 of the Revised Statutes, as amended."

NATIONAL SCIENCE FOUNDATION,
Washington, D. C.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House Office Building, Washington, D. C.

DEAR MR. HARRIS: This is in reply to your letter of February 1, 1957, requesting the comments of the National Science Foundation with regard to H. R. 4218, a bill to amend the National Science Foundation Act of 1950 to provide scholarships.

H. R. 4218 would amend section 10 of the National Science Foundation Act to authorize the Foundation to award scholarships of $500 each for successful completion of an examination in high-school mathematics and further scholarships of $500 each to such of the latter persons who also successfully complete an examination in calculus at the end of their first year of college.

The bill would appear to have three principal objectives: (1) to encourage more students to take courses in mathematics and thereby interest them in en-

tering careers in science; (2) to improve the teaching of mathematics by stimulating teacher interest; (3) to improve the content of mathematics curricula.

There is no doubt that good high-school training in mathematics is desirable for the future scientist in general and is essential for the future physical scientist and engineer. Although the percentage of those in high school taking mathematics has declined, the actual number of enrollments in high-school mathematics as well as the percentage of the total population of high-school age taking high-school mathematics are both increasing; for instance, enrollments in algebra have shown a steady growth and have more than doubled since 1922 with approximately 1.8 million high-school students enrolled in this subject in 1955. Moreover, at the present time, for every 100 students of an age group who study science and engineering in college, there are an additional 500 members of the group who have studied algebra in high school. We believe, therefore, that, even more important than encouraging students to take mathematics, is the pursuit of measures to improve the quality of the training of the increasing numbers studying mathematics.

While scholarship awards, as contemplated by H. R. 4218, would undoubtedly encourage some students to take mathematics in high school who otherwise would not have, and might indirectly encourage improvement in the teaching of mathematics in some schools, the difficulties in such a program should not be overlooked. A national program could, through the standards adopted, bring centralized Federal influence into the curriculum. It might also, due to the widely differing quality of mathematics instruction available, actually discourage many students. This possibility should be weighed along with the fact that, if the scholarships were awarded to all those presently taking advanced algebra or trigonometry in high school who might pass a reasonable examination, roughly equivalent to present college entrance requirements, the annual cost could fall between $50 and $75 million for the high-school students alone. If the program were effective and all those capable of successfully taking college work should enroll in high-school mathematics, the cost, based on the present high-school population, might exceed $200 million a year for high-school students alone. As the high-school population increases, so also would the cost. Furthermore, that portion of the bill which would provide scholarships for passing an examination in college calculus, would raise some additional problems. If calculus were singled out for encouragement by the Federal Government, there would be equally valid reasons to likewise encourage freshmen to study other particular subjects.

On January 27, 1958, the President, in a special message to the Congress, recommended a program of Federal scholarships and Federal assistance to States and institutions of higher education to meet urgent needs of education and science in the interest of national security. These recommendations are contained in identical bills, H. R. 10278 and H. R. 10279. This proposed legislation would authorize the appropriation of funds to the Department of Health, Education, and Welfare for a general scholarship program providing for approximately 10,000 scholarships annually for 4 years, with preference to be given students with good preparation in, or aptitude for, mathematics or science. Recipients would be free, as in the instant bill, to pursue studies outside the fields of mathematics and science.

Because of the increasing number of students studying mathematics, and the introduction of legislation relating to scholarship awards by the Federal Government, we believe that the Foundation's present efforts should center on other aspects of science education, including the improvement of science teaching.

The Bureau of the Budget has advised us it has no objection to the submission of this report.

Sincerely yours,

ALAN T. WATERMAN, *Director.*

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D. C., May 10, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

MY DEAR MR. CHAIRMAN: This will acknowledge your letter of February 1, 1958, requesting the views of the Bureau of the Budget on H. R. 4218, a bill to amend the National Science Foundation Act of 1950 to provide scholarships.

Under this bill the Foundation would be authorized to award scholarships of $500 to those who successfully complete an examination in high school mathematics or an examination in calculus at the end of he first year of college.

It is assumed that this bill is directed toward encouraging the study of mathematics particularly at the high-school level. These are, without a doubt, worthy objectives, but the Bureau believes that the President's education program, in H. R. 10278 or H. R. 10279, along with programs of the National Science Foundation, provides more adequately for the attainment of this goal.

H. R. 10278 authorizes a scholarship program which gives preference to individuals with good preparation in mathematics or science, thus encouraging study in mathematics. It has the advantage, unlike H. R. 4218, of providing for continuity of support for the full 4 years of college. Further, it recognizes financial need as a factor in scholarship payments. Other provisions of the President's proposal, particularly the grants to States and localities to expand and improve the teaching of science and mathematics, together with the education program of the National Science Foundation—to be expanded in 1959—will also serve directly to encourage the study of mathematics and related sciences through strengthening the teaching at the high school and college levels.

For these reasons, the Bureau of the Budget recommends against enactment of H. R. 4218 and recommends instead enactment of H. R. 10278 or H. R. 10279.

Sincerely yours,

PHILLIP S. HUGHES,
Acting Assistant Director for Legislative Reference.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE,
Washington, D. C., May 13, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

DEAR MR. CHAIRMAN: This letter is in response to your request of February 1, 1957, for a report on H. R. 4218, a bill to amend the National Science Foundation Act of 1950 to provide scholarships.

This bill would authorize the National Science Foundation to award scholarships of $500 each to those about to matriculate into college who successfully complete an examination in high-school mathematics, and to make a further $500 award to those recipients who, at the end of their first year in college, successfully complete an examination in calculus.

We assume that the objectives of the instant bill are to encourage students to study mathematics and, indirectly, to improve the level of mathematics instruction in the high schools. This Department is in full accord with these objectives, but we are unable to report favorably concerning H. R. 4218.

On January 27, 1958, in a special message to the Congress on the needs of education and science in the interest of national security, the President recommended a program of Federal scholarships and Federal assistance to States and institutions of higher education to meet urgent requirements of national security. These recommendations are embodied in H. R. 10278 and H. R. 10279, identical bills now before the Committee on Education and Labor for consideration.

H. R. 10278 and H. R. 10279 would authorize a Federal program which would include action designed to achieve the objectives of the instant bill. It would provide Federal scholarships for able high-school students who require financial assistance to pursue a course of higher education. In awarding the scholarships, preference would be given to individuals with good preparation in or high aptitude for mathematics or science. Recipients would be free, as in the instant bill, to pursue studies outside the fields of mathematics and science.

The scholarship program provided for in H. R. 10278 and H. R. 10279 differs basically from that proposed in the instant bill in that awards would be for a 4-year period, to a maximum of $1,000 annually, and would be awarded on the basis of need as well as ability. We believe this is an essential requirement of a Federal scholarship program.

We believe also that scholarship awards alone are insufficient to accomplish the objectives of the instant bill and to meet other education needs in the national interest. H. R. 10278 and H. R. 10279 would authorize Federal grants to the States and through the States to the local school districts for the expansion and improvement of the teaching of science and mathematics. It would also provide Federal assistance for States and local school districts in their testing and guidance programs so that talented young people may be identified early and may receive encouragement and guidance in preparing for college.

These provisions of H. R. 10278 and H. R. 10279 are intended not only to encourage students to study mathematics and science, but also to provide sub-

stantial assistance in improving the quantity and quality of instruction in mathematics and the sciences. Other provisions of the latter bills, while not addressed specifically to these purposes, would have an effect upon the quality of our scientific education. Knowledge of foreign languages, for instance, is essential to advanced study of the sciences, and one of the provisions of the bills would assist in correcting deficiencies in the teaching of modern foreign languages.

For the reasons given, we recommend that H. R. 10278 or H. R. 10279 be enacted instead of H. R. 4218.

The Bureau of the Budget advises that it perceives no objection to the submission of this report to your committee.

Sincerely yours,

ELLIOT L. RICHARDSON,
Acting Secretary.

[H. R. 10456, 85th Cong., 2d sess.]

A BILL To amend the National Science Foundation Act of 1950 in order to provide for certain educational programs

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 10 of the National Science Foundation Act of 1950 is amended by inserting "(a)" after "SEC. 10.", and by inserting at the end of such section the following new subsections:

"(b) In addition to such other programs as may be provided by the Foundation under the authority of this section, the Foundation—

"(1) shall establish a program under which scholarships in the form of a $500 payment are awarded annually throughout the United States, on the basis of an examination in mathematics provided by the Foundation, to individuals completing secondary school in that year;

"(2) shall provide, at a cost of not in excess of $25,000,000 during the fiscal year ending June 30, 1959, and thereafter such amounts as may be necessary, a program of summer institutes, administered by institutions of higher education, for the subject-matter training of secondary school teachers of science and mathematics; and

"(3) shall establish, at a cost of not in excess of $7,500,000 during the fiscal year ending June 30, 1959, and thereafter such amounts as may be necessary, a program of fellowships for secondary school teachers of science and mathematics.

"(c) For the purpose of providing examinations for the program of scholarships authorized in subsection (b) (1) of this section, the Foundation may enter into contracts, without regard to the provisions of section 3709 of the Revised Statutes, with individuals or organizations engaged in giving nationwide examinations at the college entrance or college level."

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D. C., May 10, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, House Office Building, Washington, D. C.

MY DEAR MR. CHAIRMAN: This will acknowledge your letter of February 5, 1958, requesting the views of the Bureau of the Budget on H. R. 10456, a bill to amend the National Science Foundation Act of 1950 in order to provide for certain educational programs.

H. R. 10456 authorizes the National Science Foundation to award $500 scholarships to high-sschool graduates on the basis of an examination in mathematics; provides up to $25 million in the fiscal year 1959 for summer institutes for high-school science and mathematics teachers; and provides $7.5 million in 1959 for the program of fellowships for science and mathematics teachers.

The Bureau concurs in the objectives of this bill which are directed toward improving the study and teaching of mathematics in high schools. The Bureau believes, however, that these objectives can be more adequately achieved under the President's education program, introduced in H. R. 10278 or H. R. 10279, and through the science education programs of the National Science Foundation which are being susbtantially expanded in the 1959 budget.

The President's program provides for scholarships which will give preference to those with a good preparation in mathematics and the sciences. It has the advantage, over H. R. 10456, of providing for support to students during the full 4 years of their college careers and the additional advantage of basing scholarship payments on financial need.

Under the 1959 budget of the National Science Foundation, the program of summer institutes for high-school science and mathematics teachers will be continued and expanded along with academic year and in-service institutes. In addition, the Foundation is proposing to inaugurate a new program of summer fellowships for high-school teachers in the sciences and mathematics.

In aggregate for these institute and fellowship programs the Foundation is planning to spend more than $35 million in 1959, which is more than the $32.5 million authorized under H. R. 10456 for programs of a similar and related nature; viz, $25 million for summer institutes and $7.5 million for fellowships.

In view of the provisions of H. R. 10278 or H. R. 10279 and the programs of the National Science Foundation, the Bureau recommends against enactment of H. R. 10456.

Sincerely yours,

PHILLIP S. HUGHES,
Acting Assistant Director for Legislative Reference.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE,
Washington, May 13, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

DEAR MR. CHAIRMAN: This letter is in response to your request of February 5, 1958, for a report on H. R. 10456, a bill to amend the National Science Foundation Act of 1950 in order to provide for certain educational programs.

This bill would authorize the National Science Foundation to (1) award annually $500 undergraduate scholarships to high-school graduates on the basis of an examination in mathematics provided by the Foundation; (2) provide, at a cost not to exceed $25 million for the fiscal year ending June 30, 1959, and such sums as may be necessary for succeeding fiscal years, a program of summer institutes, administered by institutions of higher education, for the subject-matter training of secondary school teachers of science and mathematics; and (3) establish a program of fellowships for secondary school teachers of science and mathematics.

This Department is deeply concerned with the problem of expanding the quality and quantity of educational opportunity to meet the defense and other vital needs of the Nation. The President has recommended that the Congress authorize a 4-year Federal program to stimulate and assist State, local, and private action necessary to overcome certain educational deficiencies which threaten the national security. H. R. 10278 (also H. R. 10279), now before the House Committee on Education and Labor for consideration, is designed to carry out these recommendations.

One of the authorizations contained in H. R. 10278 is for a program of Federal scholarships for able high-school graduates who need financial assistance to continue their education, combined with Federal assistance to States and institutions of higher learning to encourage the early identification of able students and the development of adequate counseling and guidance services. The funds authorized by the bill would provide approximately 10,000 new scholarships each year for a 4-year period.

The basic objective of this proposal is to help reduce the Nation's waste of human talent which occurs through the failure of able students to continue their education beyond high school. Assistance to States to provide for the early identification of able youth and for the expansion and improvement of guidance and counseling services will do much to achieve this objective. The further provision for scholarships is viewed as an integral part of this program and is designed to encourage able high-school graduates who, having been identified and properly counseled in their earlier school years, need financial assistance to continue their education. The purpose of these provisions is to encourage able students to work hard at the basic academic courses needed for college and to stimulate increased State, local, and private action to prevent this loss of talent.

The National Science Foundation Act of 1950, as amended, authorizes the Foundation to grant undergraduate scholarships for study in the sciences leading to the first post-secondary-school degree. This authority as a matter of policy, has never been exercised because of the belief that it would not be in the national interest to grant undergraduate scholarships restricted as to the field of study. The scholarships which this bill would authorize the Foundation to grant would not be restricted as to the field of study, but would be in the nature of a prize for students having a superior preparation in mathematics. We feel that this would serve a far too limited purpose—presumably to encourage students to study hard in mathematics. This purpose would also be served by the scholarship provision in H. R. 10278, which would give preference to students with good preparation in or high aptitude for mathematics or science, without neglecting the broader aim of reducing the number of able high-school graduates who do not go on to college.

Our objections to the scholarship provision in the instant bill go further, however. We believe that a Federal scholarship program should be administered by the States and should be closely tied to State and local programs for the early identification of student aptitudes and abilities and for improved counseling and guidance services, as would be provided by H. R. 10278. Moreover, the amount of scholarship awards should reflect the financial need of recipients.

The Foundation also has authority to conduct summer and academic year training institutes for secondary school teachers of science. In his budget message on January 13, 1958, and again in a special message on education on January 27, 1958, the President recommended a substantial increase in funds for the Foundation for this purpose. So far as this Department is aware, no additional authority is needed by the Foundation to accomplish this purpose. This provision of the instant bill is therefore unnecessary.

The provision of the instant bill which would authorize the Foundation to establish a program of fellowships for secondary school teachers of science and mathematics is, in our opinion, unnecessary in view of the existing authority of the Foundation to grant fellowships for advanced study in the sciences. Further, we believe that the most critical need for teachers with advanced degrees at this time is in the colleges and universities, because the growing shortage of qualified college and university teachers threatens to further impair our ability to produce an adequate supply of educated people in all fields of endeavor, including secondary education. We therefore prefer the fellowship provision set forth in title IV of H. R. 10278, which would give preference to individuals interested in teaching in institutions of higher education and would be an integral part of a Federal program to assist such institutions to expand their programs of graduate education.

For these reasons, we recommend that H. R. 10278 be enacted rather than H. R. 10456.

The Bureau of the Budget advises that it perceives no objection to the submission of this report to your committee.

Sincerely yours,

ELLIOT L. RICHARDSON, *Acting Secretary.*

[H. R. 10464, 85th Cong., 2d sess.]

A BILL To amend the National Science Foundation Act of 1950 in order to provide for certain educational programs

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 10 of the National Science Foundation Act of 1950 is amended by inserting "(a)" after "SEC. 10.", and by inserting at the end of such section the following new subsections:

"(b) In addition to such other programs as may be provided by the Foundation under the authority of this section, the Foundation—

"(1) shall establish a program under which scholarships in the form of a $500 payment are awarded annually throughout the United States, on the basis of an examination in mathematics provided by the Foundation, to individuals completing secondary school in that year;

"(2) shall provide, at a cost of not in excess of $25,000,000 during the fiscal year ending June 30, 1959, and thereafter such amounts as may be

necessary, a program of summer institutes, administered by institutions of higher education, for the subject-matter training of secondary school teachers of science and mathematics; and

"(3) shall establish, at a cost of not in excess of $7,500,000 during the fiscal year ending June 30, 1959, and thereafter such amounts as may be necessary, a program of fellowships for secondary school teachers of science and mathematics.

"(c) For the purpose of providing examinations for the program of scholarships authorized in subsection (b) (1) of this section, the Foundation may enter into contracts, without regard to the provisions of section 3709 of the Revised Statutes, with individuals or organizations engaged in giving nationwide examinations at the college entrance or college level."

[H. R. 10293, 85th Cong., 2d sess.]

A BILL To establish a national scientific research reserve fund

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act shall be titled, "The National Scientific Research Reserve Fund Act of 1958".

SEC. 2. As used in this Act—

(a) "The National Science Board" means the National Science Board as established by section 4 of the National Science Foundation Act of 1950 (64 Stat. 150; 42 U. S. C. 1863).

(b) "The Executive Committee of the National Science Board" means said Committee as established pursuant to section 6 of the National Science Foundation Act of 1950 (64 Stat. 151; 42 U. S. C. 1865).

(c) "Basic research" means that type of research which is directed toward increase of knowledge in science.

(d) "Applied research" means that type of research which is directed toward practical applications of science.

(e) "Scientific research" means systematic and intensive study directed toward a fuller knowledge of the subjected studied.

SEC. 3. There is hereby established in the Treasury of the United States a fund to be designated "The National Scientific Research Reserve Fund." The authorized amount of said fund shall be $200,000,000, plus any additional amounts which may be appropriated therefor. The fund shall be activated by an original appropriation hereto and shall be replenished by annual appropriations. All moneys appropriated or otherwise accruing to the fund shall be available until expended pursuant to this Act.

SEC. 4. Said fund shall be expended for basic and applied scientific research upon a vote of the executive committee of the National Science Board and in the manner prescribed by the committee: *Provided, however,* That the committee shall find that the initiation or continuation of each project for which expenditure from the fund is approved is of sufficient importance and urgency, in its opinion, to justify an immediate expenditure without carrying out the usual budgetary and appropriation procedures.

SEC. 5. After receipt of the annual report of the executive committee, the National Science Board shall, as soon as possible, report to the Senate and to the House of Representatives the following information:

(a) The status of the fund at the close of the year;

(b) The expenditures made or committed from the fund since the last report;

(c) The projects for which such expenditures were made or committed;

(d) The progress on and results attained from projects financed in whole or in part by the fund.

SEC. 6. In the event any moneys are received by the United States as a result of projects financed by the fund such moneys shall be paid into the fund in such proportion as the share of the project financed by the fund bears to the total amount financed by the United States.

SEC. 7. Actions taken by the executive committee of the National Science Board under this Act shall be by a majority of the members present at a meeting at which a quorum, consisting of a majority of the voting members of the Board, is present.

SMITHSONIAN INSTITUTION,
Washington, D. C., May 19, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

DEAR MR. HARRIS: Reference is made to letters dated February 19 and 20, 1958, from Hon. William L. Dawson, chairman of the Committee on Government Operations, regarding H. R. 10293, a bill to establish a national scientific research reserve fund, and to my acknowledgment dated February 24, 1958.

The Smithsonian Institution is of the opinion that a national scientific research reserve fund would serve a very valuable purpose. It would encourage scientific scholars to continue to do research, as they would be assured that funds would be available to complete meritorious projects. A reserve fund would actually save money in that it would prevent the waste that would result if the researches on which funds had been expended would have to be discontinued before being completed.

The Bureau of the Budget advises that there is no objection to the submission of this report to the Congress.

Sincerely yours,

LEONARD CARMICHAEL, *Secretary.*

NATIONAL SCIENCE FOUNDATION,
Washington, D. C.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

MY DEAR MR. HARRIS: This is in reply to your letter of January 20, 1958, requesting the comments of the National Science Foundation with regard to H. R. 10293, a bill to establish a national scientific research reserve fund.

H. R. 10293 would establish in the Treasury of the United States a fund to be designated the national scientific research reserve fund. The bill states that the authorized amount of said fund shall be $200 million, plus any additional amounts which may be appropriated therefor. The fund shall be activated by an original appropriation thereto and shall be replenished by annual appropriations. Expenditures from the fund would be authorized by a vote of the Executive Committee of the National Science Board, provided the Committee finds that the initiation or continuation of each project for which expenditure from the fund is approved is of sufficient importance and urgency, in its opinion, to justify an immediate expenditure without carrying out the usual budgetary and appropriation procedures. A report on the status of the fund would be required annually from the National Science Board following its receipt of the annual report of the Executive Committee.

The National Science Board at its meeting of March 14, 1958, expressed itself as favoring the general principle of promoting the continuity of research support and of providing means for making funds more quickly available for urgent research undertakings than is possible under the normal appropriation process. The Board expressed itself, however, as believing that the use of a general fund available to all agencies of the Government would have to be strictly limited in the area of applied research to those instances where research must be commenced immediately to meet an urgent national need and where the agency in question could not possibly finance it out of any funds otherwise available to it.

With these general comments, we believe that such a fund as would be established under H. R. 10293 could prove very useful in permitting the prompt prosecution of important research projects without delay or interruption. In line with the preceding comments, we would recommend that the words "scientific research" be substituted for the words "basic or applied research" in the first sentence of section 4 of the bill so as to place less emphasis upon the provision of funds for applied research activities. If such a fund were generally made available for emergency applied research support, we believe that, because of the greater financial requirements of applied research, the demands upon the fund might be so great as to seriously impair its usefulness for extremely urgent basic research.

In addition, we suggest that, since the National Science Board, under the National Science Foundation Act of 1950, has statutory responsibility for establishing the policies of the Foundation, the words "in accordance with policies es-

tablished by the National Science Board" be added after the word "Committee" in line 22 on page 2 of the bill.

We note that section 7 of the bill states that actions taken by the Executive Committee shall be by a majority of the members present at a meeting at which a quorum consisting of a majority of the members "of the Board" is present. The word "Board" should be changed to the word "Committee."

The National Science Board indicated that, if legislation such as that proposed in H. R. 10293 were enacted, the initial amount requested for the fund should be substantially less than $200 million, so as to commence operations with the fund on an experimental basis until the problems involved are more clearly understood.

Thank you for giving us the opportunity to comment on the bill.

The Bureau of the Budget has advised us it has no objection to the submission of this report.

Sincerely yours,

ALAN T. WATERMAN, *Director.*

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D. C., May 10, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, House Office Building, Washington, D. C.

MY DEAR MR. CHAIRMAN: This will acknowledge your letter of January 30, 1958, requesting the views of the Bureau of the Budget on H. R. 10293, a bill to establish a national scientific research reserve fund.

H. R. 10293 would establish a national scientific research reserve fund under control of the Executive Committee of the National Science Board of the National Science Foundation. The authorized amount of the fund would be $200 million plus any additional amounts appropriated and would be replenished annually. It would be expended by the Executive Committee for basic and applied research where initiation or continuation of a project is of sufficient importance and urgency to justify an immediate expenditure without carrying out the usual budget and appropriation procedures.

While unforeseen research needs can arise from time to time, which were not planned in the development of budget estimates, the Bureau questions the appropriateness of such a fund in the National Science Foundation. The principal justification for a fund available outside the normal annual and supplementary appropriation processes would be that there are research needs of such an emergency nature that time is not available to permit reliance on these normal processes. The principal area in which time might be of the essence is that of the Nation's defense requirements; in this case there is already an emergency appropriation for research and development in the Department of Defense. In other areas of the Government it is questionable whether the time factor is of such importance as to justify an emergency fund.

It is also questionable whether the Foundation should be identified with the support of applied research. Since its establishment it has been associated solely with research of a basic or fundamental nature. Federal support of applied research should continue to be justified and financed through the mission-related programs of the various departments and agencies of the Government. In limiting the Foundation to basic research, therefore, there is even less reason for considering the emergency fund approach, since such research by its very nature does not call for support on a "crash" basis.

To the extent that needs may arise in the Foundation for support of a project or activity for which no funds were budgeted, it would appear that the Foundation can meet such needs through the normal appropriation process, either in annual budget requests or in supplemental estimates. It should be noted that the size of the Foundation's appropriations has increased substantially in recent years, particularly the increase from $40 million in 1958 to the $140 million proposed in 1959, and more flexibility is therefore available to the Foundation within its total appropriation to meet unforeseen research needs as they arise and to assure continuity of support for projects in basic research undertaken either under Foundation grants or under the auspices of other agencies.

Sincerely yours,

ROGER W. JONES,
Assistant Director.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE,
Washington, May 13, 1958.

Hon. OREN HARRIS,
Chairman, Commitee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

DEAR MR. CHAIRMAN: This letter is in response to your request of January 30, 1958, for a report on H. R. 10293, a bill to establish a national scientific research reserve fund.

This bill would provide for the establishment of a research fund of $200 million to be expended for basic and applied scientific research upon a vote of the executive commitee of the National Science Board when such expenditure is determined to be of sufficient importance and urgency to justify an immediate action without carrying out the usual budgetary procedures. Provision is made for annual appropriations to replenish the fund as required, and an annual report to the Congress on the status of the fund and the expenditures made or committed during each year is called for.

This Department is sympathetic with the principles which this bill apparently seeks to serve. Means to permit greater flexibility, stability, and continuity in the support of scientific research activites are most important. Apparently, this proposal is not intended to provide a single source of support for a balanced program of Government-financed research for all important fields of scientific activity; nor to replace customary administrative and budgetary decisions and processes in relation to Government research support in general. Its purpose appears to be, rather, to provide "free" funds with which to follow promising new leads or to make possible continuation of promising projects which have been discontinued through loss of support from the initial source, whether Federal or non-Federal. Thus, the administration of this reserve fund could both supplement and, in some cases, counteract the research support policies of other Federal agencies.

In the view of this Department, the problem presented by the establishment of a fund as proposed in this bill is twofold:

1. This fund could obscure the necessity for adequately supported, broadly planned and balanced research programs as distinguished from the ad hoc exploitation of particular research opportunities.

2. The administration of the fund would not necessarily insure either balance or continuity in support of research, particularly in the fields of scientific research which are now the special responsibility of other existing Federal agencies.

The effect of this proposal upon the current Federal programs of research and research support is an especially troublesome question because of the almost complete absence from the bill of any guidelines—either in respect to the scientific objectives to be furthered or the manner in which the fund would be administered. If such a propossal were to be favorably considered, the relationship of the proposed new research fund to the activities of other Federal agencies supporting scientific and research activities would need to be clarified.

The bill would impose an extraordinary responsibility upon a small part-time group—namely the executive committee of the National Science Board which, under present law, does not have policymaking responsibilties. We seriously question whether the administration of programs of such magnitude should be located entirely outside the normal channels of executive responsibility.

Therefore, for the reasons set forth above, this Department does not recommend enactment of H. R. 10293.

The Bureau of the Budget advises that it perceives no objection to the submission of this report to your committee.

Sincerely yours,

ELLIOT L. RICHARDSON,
Acting Secretary.

EXECUTIVE OFFICE OF THE PRESIDENT,
OFFICE OF DEFENSE MOBILIZATION,
Washington, D. C., May 15, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

DEAR MR. HARRIS: This is in reply to your letter of March 7 requesting a report from this agency concerning H. R. 10293, a bill to establish a national scientific research reserve fund.

This office heartily supports the general principle of promoting scientific research and would favor appropriate measures for Government participation in research endeavors. We are thus sympathetic with the objectives of the bill. However, with respect to the desirability of the particular device proposed by the bill and its relation to the normal budgetary policies of the Government, we must defer to the views of the Bureau of the Budget and other agencies more directly concerned with the activities in question.

The Bureau of the Budget advises that it has no objection to the submission of this report.

Sincerely yours,

GORDON GRAY, *Director.*

DEPARTMENT OF AGRICULTURE,
Washington, D. C., April 3, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives.

DEAR CONGRESSMAN HARRIS: This is in reply to your request of March 7 for a report on H. R. 10293, a bill to establish a national scientific research reserve fund.

The bill would establish in the United States Treasury, the national scientific research reserve fund of $200 million, plus any additional amounts appropriated. All money appropriated or accruing to the fund would be available until expended. Expenditures from the fund would be for basic and applied scientific research, ig in the opinion of the executive committee of the National Science Board (established by the National Science Foundation Act of 1950), a project is of sufficient importance and urgency to justify an immediate expenditure without resorting to the regular budgetary process. The bill would require the Board to report to the Congress (1) status of the fund at the close of the year, (2) expenditures made or committed since the preceding report, (3) projects for which expenditures were made or committed, and (4) progress on and results attained from projects financed in whole or in part from the fund.

The bill does not directly affect any activity of this Department; accordingly, we believe that the National Science Foundation would be in a better position to submit a definitive recommendation.

Thank you for giving us an opportunity to comment upon this bill.

Sincerely yours,

TRUE D. MORSE, *Acting Secretary.*

DEPARTMENT OF LABOR,
Washington, April 10, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

DEAR CONGRESSMAN HARRIS: This is in further response to your request for a report on H. R. 10293, a bill to establish a national scientific research reserve fund.

The bill would establish a national scientific research reserve fund of $200 million which would be expended for basic and applied scientific research as prescribed by the executive committee of the National Science Board. No limitations would be placed upon the discretion of the committee other than that its determinations respecting expenditures would have to be made by majority vote of the members. The Board would report the projects for which expenditures were made or committed annually to the Congress.

The National Science Foundation has made funds available for certain special projects conducted by this Department. However, no significant problems have arisen respecting the arrangements for financing these projects and none would apparently arise under H. R. 10293. Since the bill would have little effect on the operations of this Department, we would prefer to leave comment with those agencies which are more directly concerned.

The Bureau of the Budget advises that there is no objection to the submission of this report.

Sincerely yours,

JAMES T. O'CONNELL,
Acting Secretary of Labor.

[H. R. 11257, 85th Cong., 2d sess.]

A BILL To amend the National Science Foundation Act of 1950, as amended, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Science Foundation Act of 1950, as amended, is amended as follows: Section 4 (d) and section 4 (e) of the National Science Foundation Act of 1950, as amended, are amended to read as follows:

"(d) The Board shall meet annually on a day during the last two weeks of May and at such other times as the Chairman may determine, but he shall also call a meeting whenever one-third of the members so request in writing. A majority of the voting members of the Board shall constitute a quorum. Each member shall be given notice, by registered mail mailed to his last known address of record not less than fifteen days prior to any meeting, of the call of such meeting.

"(e) The first Chairman and Vice Chairman of the Board shall be elected by the Board to serve until the first Monday in December next succeeding the date of election at which time a Chairman and Vice Chairman shall be elected for a term of two years. Thereafter such election shall take place at the second annual meeting occurring after each such election. The Vice Chairman shall perform the duties of the Chairman in his absence. In case a vacancy occurs in the chairmanship or vice chairmanship, the Board shall elect a member to fill such vacancy."

SEC. 2. Section 5 (b) of the National Science Foundation Act of 1950, as amended, is amended to read as follows:

"(b) In addition to the powers and duties specifically vested in him by this Act, the Director shall, in accordance with the policies established by the Board, exercise the powers granted by sections 10 and 11 of this Act, together with such other powers and duties as may be delegated to him by the Board; but no final action shall be taken by the Director in the exercise of any power granted by section 10 or 11 (c) unless in each instance the Board has reviewed and approved the action proposed to be taken, or such action is taken pursuant to the terms of a delegation of authority from the Board to the Director or to the Executive Committee."

SEC. 3. Section 6 (a) and section 6 (b) (1) of the National Science Foundation Act of 1950, as amended, are amended to read as follows:

"SEC. 6 (a) The Board is authorized to appoint from among its members an Executive Committee, and to assign to the Executive Committee such of the powers and functions granted to the Board by this Act as it deems appropriate; except that the Board may not assign to the Executive Committee the function of establishing policies.

"(b) If an Executive Committee is established by the Board—

"(1) such Commitee shall consist of the Director, as a nonvoting ex officio member, and not less than five nor more than nine other members elected by the Board from among their number;

"(2) the term of office of each voting member of such Committee shall be two years, except that (A) any member elected to fill a vacancy occurring prior to the expiration of the terms for which his predecessor was elected shall be elected for the remainder of such term; and (B) the term of office of four of the members first elected after the date of enactment of this Act shall be one year;

"(3) any person who has been a member of such Committee for six consecutive years shall thereafter be ineligible for election during the two-year period following the expiration of such sixth year;

"(4) the membership of such Committee shall, so far as practicable, be representative of diverse interests and shall be so chosen as to provide representation, so far as practicable, for all areas of the Nation;

"(5) such Committee shall render an annual report to the Board, and such other reports as it may deem necessary, summarizing its activities and making such recommendations as it may deem appropriate. Minority views and recommendations, if any, of members of the Executive Committee shall be included in such reports."

SEC. 4. Section 10 of the National Science Foundation Act of 1950, as amended, is amended to read as follows:

"SEC. 10. The Foundation is authorized to award, within the limits of funds made available specifically for such purpose pursuant to section 16, scholarships and graduate fellowships for scientific study or scientific work in the mathematical, physical, medical, biological, engineering, and other sciences at appropriate nonprofit American or nonprofit foreign institutions selected by the recipient of such aid, for stated periods of time. Persons shall be selected for such scholarships and fellowships from among citizens of the United States, and such selections shall be made solely on the basis of demonstrated and potential ability; but in any case in which two or more applicants for scholarships or fellowships, as the case may be, are deemed by the Foundation to be possessed of substantially equal ability, and there are not sufficient scholarships or fellowships, as the case may be, available to grant one to each of such applicants, the available scholarship or scholarships or fellowship or fellowships shall be awarded to the applicants in such manner as will tend to result in a wide distribution of scholarships and fellowships among the States, Territories, possessions, and the District of Columbia."

SEC. 5. Section 11 (c), section 11 (d), and section 11 (e) of the National Science Foundation Act of 1950, as amended, are amended to read as follows:

"SEC. 11. The Foundation shall have the authority, within the limits of available appropriations, to do all things necessary to carry out the provisions of this Act, including, but without being limited thereto, the authority—

"(c) to enter into contracts or other arrangements, or modifications thereof, for the carrying on, by organizations or individuals in the United States and foreign countries, including other Government agencies of the United States and of foreign countries, of such scientific activities as the Foundation deems necessary to carry out the purposes of this Act, and, at the request of the Secretary of Defense, specific scientific activities in connection with matters relating to the national defense, and, when deemed appropriate by the Foundation, such contracts or other arrangements, or modifications thereof, may be entered into without legal consideration, without performance or other bonds, and without regard to section 3709 of the Revised Statutes (31 U. S. C. 529);

"(d) to make advance, progress, and other payments which relate to scientific activities without regard to the provisions of section 3648 of the Revised tSatutes (31 U. S. C. 529);

"(e) to acquire by purchase, lease, loan, gift, condemnation, or otherwise, and to hold and dispose of by grant, sale, lease, loan, or otherwise, real and personal property of all kinds necessary for, or resulting from, the exercise of authority granted by this Act."

SEC. 6. Section 13 (a) of the National Science Foundation Act of 1950, as amended, is amended to read as follows:

"SEC. 13. (a) The Foundation is hereby authorized to facilitate any international scientific activities consistent with the purposes of this Act and to expend for such international scientific activities such sums within the limit of appropriated funds as the Foundation may deem desirable. The Director, with the approval of the Board, may defray the expenses of representatives of Government agencies and other organizations and of individual scientists to accredited international scientific congresses and meetings whenever he deems it necessary in the promotion of the objectives of this Act. In this connection, with the approval of the Secretary of State, the Foundation may undertake programs granting scholarships and fellowships to, or making other similar arrangements with, foreign nationals for scientific study or scientific work in the United States or foreign countries without regard to section 10 or the affidavit of allegiance to the United States required by section 15 (d) (2) of this Act."

SEC. 7. Section 13 (b) of the National Science Foundation Act of 1950, as amended, is amended by inserting in lieu thereof a new section 13 (b) as follows:

"(b) The Foundation is also authorized, with the approval of the Secretary of State, to undertake programs providing for the conduct or facilitation of such

other scientific activities abroad as are deemed to be in the interest of the United States."

SEC. 8. Section 13 of the National Science Foundation Act of 1950, as amended, is further amended by renumbering former section 13 (b) to become section 13 (c) and by amending section 13 (c) (1) to read as follows:

"(c) (1) The authority to enter into contracts or other arrangements with organizations or individuals in foreign countries and with agencies of foreign countries, as provided in section 11 (c), and the authority to facilitate international scientific activities as provided in subsection (a) and (b) of this section, shall be exercised only with the approval of the Secretary of State, to the end that authority to undertake such programs shall be exercised in such manner as is consistent with the foreign policy objectives of the United States.

"(2) If, in the exercise of the authority referred to in paragraph (1) of this subsection, negotiation with foreign countries or agencies thereof becomes necessary, such negotiation shall be carried on by the Secretary of State in consultation with the Director."

SEC. 9. Section 14 of the National Science Foundation Act of 1950, as amended is amended by adding a new subsection "j" at the end thereof to read as follows:

"(j) To the extent he finds it will contribute to the more effective functioning of the National Science Foundation, the Director is authorized to conduct or provide training and to assign employees for training or attendance at meetings at Federal or non-Federal facilities, including public or private agencies, institutions of learning, laboratories, industrial or commercial organizations or other appropriate organizations or institutions, and, if he deems it appropriate, to pay in whole or in part, the following: The salaries of such employees for the period of training or attendance; the cost of their transportation and per diem in lieu of subsistence in accordance with the Travel Expense Act of 1949, as amended; necessary expenses incident to their training including tuition, study materials, and other customary expenses. Appropriations or other funds available to the National Science Foundation for salaries and for expenses shall be available for the purposes of this subsection.

"An employee who accepts assignment for training for more than fifteen days at any one time shall agree in writing to remain in the Government service, unless involuntarily separated therefrom, for a period equal to three times the length of any time off with pay granted without charge to annual leave for the purpose of such training. Any such trainee who fails to fulfill such agreement shall be required to reimburse the Government for whatever portion of the travel, subsistence, tuition, fees, and related expenses paid by the Government during such training the Director determines to be appropriate."

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D. C., April 21, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

MY DEAR MR. CHAIRMAN: This will acknowledge your letter of March 13, 1958, requesting the views of the Bureau of the Budget on H. R. 11257, to amend the National Science Foundation Act of 1950, as amended, and for other purposes.

This bill incorporates amendments of the National Science Foundation Act proposed by the Foundation in a letter to the Speaker of the House dated February 10, 1958. It is believed that the changes in basic legislation proposed, involving chiefly technical amendments, will facilitate the work of the Foundation in promoting basic research and other activities related to this mission. Accordingly, the Bureau of the Budget would have no objection to enactment of H. R. 11257.

Sincerely yours,

PHILLIP S. HUGHES,
Acting Assistant Director for Legislative Reference.

DEPARTMENT OF STATE,
Washington, April 24, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives.

DEAR MR. HARRIS: Further reference is made to your request of March 13, 1958, for comment of the Department of State on H. R. 11257, to amend the National Science Foundation Act of 1950, as amended, and for other purposes.

The Department of State interposes no objection to the passage of the proposed legislation.

The Department has been informed by the Bureau of the Budget that there is no objection to the submission of this report.

Sincerely yours,

WILLIAM B. MACOMBER, Jr.,
Assistant Secretary
(For the Secretary of State).

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE,
Washington, May 6, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

DEAR MR. CHAIRMAN: This letter is in response to your request of March 13, 1958, for a report on H. R. 11257, a bill to amend the National Science Foundation Act of 1950, as amended, and for other purposes.

The bill would amend the act principally to effect certain changes in the administrative procedures followed by the Foundation and to authorize the Foundation to support or to facilitate international scientific activities rather than merely to cooperate in international research activities. The additional authorization would include the granting of fellowships to foreign nationals for scientific study or work.

This Department would favor the provisions of H. R. 11257. As you know, our legislative program includes recommendations for a 4-year Federal program to assist and encourage State, local, and private action to overcome certain educational deficiencies in the interest of national security. The program which we have recommended includes measures designed to expand and strengthen education in mathematics and the sciences. The existing programs of the National Science Foundation are producing valuable results in this field and would complement the program set forth in our legislative recommendations (as embodied in H. R. 10278).

The expanded authorization with respect to the Foundation's participation in international scientific activities, contained in the instant bill, would, in our judgment, further the Foundation's effectiveness in carrying out their programs. Scientific progress and achievement are increasingly the product of work going on in many nations, and it is essential to our efforts to strengthen our own scientific research and education that we cooperate effectively with scientists abroad. The work of the Foundation in facilitating this cooperation serves to strengthen and supplement programs of this Department having to do with research and education in the sciences.

We would therefore recommend enactment of H. R. 11257.

The Bureau of the Budget advises that it perceives no objection to the submission of this report to your committee.

Sincerely yours,

ELLIOT L. RICHARDSON,
Acting Secretary.

GENERAL COUNSEL OF THE DEPARTMENT OF DEFENSE,
Washington, D. C., May 28, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives.

DEAR MR. CHAIRMAN: Reference is made to your request for comments of the Department of Defense on H. R. 11257, 85th Congress, a bill to amend the National Science Foundation Act of 1950, as amended, and for other purposes.

The bill provides for certain internal operational changes for the Foundation. In addition, the proposed legislation expands the authority of the Foundation to engage in international science activities. Finally, the Foundation is permitted to conduct or provide training for its employees and to assign employees to attend schools and meetings, and to pay in whole or part thereof the cost of such attendance.

The Department of Defense interposes no objection to the proposed legislation.

The Bureau of the Budget has advised that there is no objection to the submission of this report to the Congress.

Sincerely yours,

ROBERT DECHERT.

UNITED STATES DEPARTMENT OF JUSTICE,
OFFICE OF THE DEPUTY ATTORNEY GENERAL,
Washington, D. C., May 26, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

DEAR MR. CHAIRMAN: This is in response to your request for the views of the Department of Justice concerning the bill (H. R. 11257) to amend the National Science Foundation Act of 1950, as amended, and for other purposes.

This legislation would clarify the authority of the Foundation, broaden that authority in some respects, and provide a number of technical improvements in the National Science Foundation Act. Whether it should be enacted constitutes a question of policy concerning which the Department of Justice prefers to make no recommendation.

The Bureau of the Budget has advised that there is no objection to the submission of this report.

Sincerely yours,

LAWRENCE E. WALSH, *Deputy Attorney General.*

UNITED STATES CIVIL SERVICE COMMISSION,
Washington, D. C., May 8, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

DEAR MR. HARRIS: Your letter of March 15, 1957, requested our views on H. R. 11257, a bill which you introduced to amend the National Science Foundation Act of 1950, as amended, and for other purposes.

Although the bill contains a number of provisions, only one of these directly concerns employees in the competitive service. Our comments are confined to this provision, carried in section 9.

Section 9 would authorize the Director of the Foundation, to the extent he finds it will contribute to more effective functioning of the Foundation, to assign employees to training or to meetings and to pay their salaries, the costs of their transportation and per diem, and other necessary expenses incident to training. Employees trained more than 15 days at any 1 time would be required to agree to remain in Government (unless involuntarily separated) for a period equal to 3 times the length of time off with pay granted for training without charge to annual leave or to repay such part of the travel, subsistence, tuition, fees, and related training expenses as the Director deems appropriate.

The National Science Foundation, like other agencies, needs clear authority to train its employees at Government expense in both Federal and non-Federal facilities. We much prefer that this need be met through Government-wide authority such as that carried in S. 385, the administration's training proposal, rather than through specific legislation for individual agencies. If early action

is not taken to pass general training legislation, however, we strongly recommend approval of the training provision carried in H. R. 11257, so that the Foundation may receive the training authority it needs to operate effectively.

The Bureau of the Budget informs us that there is no objection to the submission of this report to your committee.

By direction of the Commission:

Sincerely yours,

HARRIS ELLSWORTH, *Chairman.*

COMPTROLLER GENERAL OF THE UNITED STATES,
Washington, March 31, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives.

DEAR MR. CHAIRMAN: Further reference is made to your letter of March 13, 1958, acknowledged March 14, requesting our comments on H. R. 11257, 85th Congress, 2d session.

H. R. 11257 would amend the National Science Foundation Act of 1950, as amended, to change the date of the annual meeting of the National Science Board, to permit greater delegation of powers, and to provide greater flexibility in membership of executive committees. Additionally, the bill would liberalize the authorization for scholarships and fellowships, provide broader authority for participation in international scientific activities, permit the acquisition of property by condemnation, and authorize in-service training of employees.

We have no information relative to the extent of the necessity for the broader authority which would be granted by sections 1 through 8 of the bill and we therefore offer no comments with respect to the provisions contained therein. However, your attention is invited to the provisions of section 9 of the bill, which would authorize the Director of the National Science Foundation to conduct or provide employee training and to assign employees for training at public or private agencies, institutions of learning, laboratories, industrial or commercial organizations, or other appropriate organizations or institutions. While we are generally of the opinion that legislation designed to authorize the expenditure of appropriated funds for civilian employee training should be enacted in a form which would apply uniformly to the various agencies and departments of the Government, rather than the enactment of piecemeal legislation on an individual agency basis, we realize that the employee training needs of the National Science Foundation may be sufficiently unique and pressing to justify immediate individual training authorization. However, we note that section 9 fails to place any limitation, other than the total amount of appropriated or other funds available for payment of salaries and expenses, on either the number of employees receiving training at any one time, or the maximum amount of training which an employee may receive in any specified period. In this connection, your attention is invited to the provisions of section 12 (a) of H. R. 6001, 85th Congress, which proposes a general grant of training authority to Government agencies and which would limit the number of man-years of employee training in, by, and through non-Government facilities to 1 percent of the total number of man-years of civilian employment in each agency and would further limit such training received by any individual employee to 1 year for each 10 years of service. We therefore suggest consideration of the addition of similar, but not necessarily identical, limitations in H. R. 11257.

With respect to the reimbursement required by section 9 in case of failure of the employee to remain in the Government service for a period equal to three times the length of his training period, it would appear desirable to include specific authority for collection action by the United States where such action is necessary to effect reimbursement. In this connection, your attention is invited to section 11 (c) of H. R. 6001 which would authorize setoff of accrued salary, retirement credits or other amounts due an employee who fails to fulfill his employment agreement.

Sincerely yours,

FRANK H. WEITZEL,
Assistant Comptroller General of the United States.

Mr. WILLIAMS. Our first witness this morning is our distinguished colleague from the State of Illinois, Hon. Melvin Price, who is the author of two bills before the committee, H. R. 4218 and H. R. 10456.

STATEMENT BY HON. MELVIN PRICE, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS

Mr. PRICE. Mr. Chairman, I will address my remarks this morning to H. R. 10456, since it is an implementation of the original bill. It goes a step further but the main substance of the bill is the same.

Mr. Chairman, it is a pleasure to appear before your subcommittee again this year in support of the legislation which Congressman Van Zandt and I have introduced in the House to provide means by which we can insure an adequate supply of scientific and engineering manpower in this country for the future.

Mr. WILLIAMS. Mr. Price, are those bills identical?

Mr. PRICE. They are not identical; 10456 implements the first bill, the number of which escapes me.

Mr. WILLIAMS. No, I mean your bill and Congressman Van Zandt's?

Mr. PRICE. Mr. Van Zandt's bill and my bill are identical, yes.

Mr. WILLIAMS. Thank you very much.

Mr. PRICE. As members of the Joint Committee on Atomic Energy, Congressman Van Zandt and I have personally concerned ourselves with this scientific manpower problem for a number of years past, and with other members of the Research and Development Subcommittee held extensive hearings on the matter in the spring of 1956. I might state that our study at that time was more or less directed to its effect on the atomic energy program. I believe that I outlined to you last year the objectives we had in mind in sponsoring these hearings and the conclusions we reached as a result of hearing testimony from some 30 expert witnesses.

To review briefly, most of us began the hearings with the feeling that special-purpose legislation must be enacted to stimulate this country's efforts in producing adequate numbers of scientists and engineers. We were daily reminded of the dramatic strides which the Russians had taken in scientific advancement and of their massive educational program designed to outproduce the free world, both in quantity and quality, in the output of trained technical people. This Soviet initiative in the field of technology was then and continues today to pose a serious threat to the free world. Even the most skeptical have been brought to this conclusion by recent dramatic Soviet successes in the field of science, epitomized last fall by their launching of their earth satellites.

But the more we looked at the problem and the more we listened to the testimony of our expert witnesses, the more we began to appreciate the fact that the need for scientists and engineers in the future is only part of a larger need in America for specialized talent of all kinds, across the board. Therefore, if we are to compete effectively with the Russians in the years ahead, we must devote ourselves to producing greater numbers of talented young people in many fields of endeavor, including the science and engineering fields. If we allow ourselves to be rushed into ill-considered and narrow-purpose measures, in response to the pressing needs of the moment, without relating these measures to this larger overall need, we shall in fact be producing weaknesses rather than strength in the social and economic fabric of this country.

This is not to say, however, that within this general framework of national needs, concrete action cannot be taken to insure that America

has adequate supplies of scientists and engineers for the future. There are measures which can and should be taken promptly, but they must be addressed to the roots of the problem, not simply its surface manifestations. These roots are chiefly found in deficiencies which have developed over the years in our educational system, particularly at the secondary-school level.

Among the greatest of these deficiencies, and one which was mentioned repeatedly by the expert witnesses at our hearings, was the serious deterioration in recent years of the quality of mathematics instruction in our high schools. This deterioration has had two serious consequences. First, it has denied many of our young people a well-balanced education through depriving them of adequate instruction in one of the traditional and basic subjects of American education. Second, inadequate mathematics instruction at the secondary school level had made it impossible in many instances for young people of potential talent to pursue scientific and engineering courses at the college level because of inadequate background. This loss of potential talent can only be estimated in very rough terms but it undoubtedly numbers in the thousands each year. This is a serious and needless waste of our most precious national resource; namely, the potential talents of our young people to whom we must look for our leadership in the years to come.

Mr. Chairman, the legislation which Congressman Van Zandt and I propose addresses itself directly to this problem. It has, essentially, three major provisions. The first would establish a $500 scholarship award for any high-school senior who could pass an examination in the traditional subjects of mathematics at a given level of difficulty. The program would be administered by the National Science Foundation, which would select a competent organization, such as the Educational Testing Service at Princeton, to prepare and give the necessary examinations.

This $500 award, originally proposed at our hearings in the spring of 1956 by Dr. I. I. Rabi of Columbia University, would have several advantages. First of all it would provide a great stimulus to the student in his study of mathematics at the secondary school level. It would also have the effect of stimulating local action, both at the parental and community group level, to insure better mathematics instruction in local high schools. These objectives would be achieved without running into the danger of Federal interference with local school authorities.

There would be absolutely no strings attached to this award. Winners of the award would be free either to pursue their education in the science and engineering fields or to go into any other line of activity which they choose. This would have the double benefit of providing a stimulus for a well-rounded curriculum for all students, whether they go into science and engineering or not, and at the same time provide the essential background for those students who have a natural interest in science and engineering and through their own decision go on to college level studies and careers in these fields.

Beyond the need for stimulating greater interest on the part of students and their parents in high-school mathematics is the pressing requirement for assisting local high-school mathematics and science teachers in providing the necessary quality of instruction and inspira-

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tion to the students. A great deal has been said about the unfortunate position in which many of these teachers find themselves, and much of it, I regret to say, is true. We can and we must take steps now to remedy this situation if we care at all about the kind of education our young people are receiving. Once again, we must be careful that there is no undue Federal interference with local school authorities. On the other hand, there are Federal measures which can be taken within this framework to assist our high-school teachers to improve their own level of competence and in the process improve the curriculum.

One of the most successful means to date of meeting this need has been the summertime refresher courses for high-school teachers which have been held for the past several years under the auspices of the National Science Foundation. Through the cooperation of universities and institutions throughout the country, hundreds of teachers have attended special summer courses which average about 6 weeks' duration. Stipends of $75 per week are offered together with $15 per dependent. The cost of running the courses is borne mutually by the Foundation and the participating university.

While the program is excellent as far as it goes, it does not go far enough on its present limited budget to meet mounting needs. For example, the Foundation was able to provide funds for 108 institutions last year of its relatively small budget of $5.3 million. However, there were double that number of qualified institutions who proposed to set up summer institutes with the Foundation's cooperation but were unable to do so because of lack of funds. It is conservatively estimated that in addition to this, there are at least 200 other qualified institutions in this country who have not made specific proposals to the Foundation but who might be encouraged to join the program if funds were made available.

To meet this need, the legislation before you proposes that the present summer institute program of the National Science Foundation be quadrupled in size and that the funding level for the program be increased to $25 million. Through such action we would be taking an already going concern and, by expanding its activities, increasing the number of teachers being assisted with a minimum of delay.

A third provision of the bill addresses itself to the related problem of providing advanced training for those high-school teachers who already have their bachelor's degree but who wish to improve their own knowledge. Such additional training is particularly important in schools where there are students of exceptional ability who need and should have the stimulation of advanced study given by a competent teacher. To this end the legislation I have introduced would establish a new program for the National Science Foundation to provide summer fellowships for those high-school teachers who already have their bachelor of arts degree. Such a program should serve as a valuable supplement to the summer institute program. It would serve the double purpose of providing advanced instruction for our more talented young people and at the same time help bring up the quality of instruction all the way up and down the line. Essentially, it would place a premium on competence, something that is badly lacking in many of our schools at the present time.

The legislation before you does not attempt to provide answers to all of our pressing educational problems, nor to the need for more

vigorous action on the part of local communities to develop the talents of our young people. But I am convinced that the provisions of this bill, if carried out, would be an important first step toward insuring that the United States will have an adequate supply of scientific and engineering manpower to meet the scientific challenge of the future. It will help meet this challenge, moreover, within the context of our overall needs and without causing the serious imbalances in our society and economy which narrow purpose legislation inevitably would create.

It cannot be overemphasized that our young people are our most important resource for the future. We can and we must see to it that they are given every opportunity to develop themselves to their fullest capacity. For this reason, I sincerely hope that the legislation which Congressman Van Zandt and I have proposed will receive favorable consideration by your committee.

Thank you.

Mr. WILLIAMS. Thank you very much.

Mr. Loser?

Mr. LOSER. I have nothing at all, Mr. Chairman.

Mr. WILLIAMS. Dr. Neal?

Mr. NEAL. I have no questions, thank you.

Mr. WILLIAMS. Is there any provision in your bill with regard to teachers in particular, that would prohibit participation in your program by teachers who may be Communist or who have a Communist background?

Mr. PRICE. That was not included in this legislation, no. There are no prohibitive features in this legislation at all, Mr. Chairman.

Mr. WILLIAMS. What would be your feeling about amending the bill to include that type of provision?

Mr. PRICE. Of course, that would be determined by the wisdom of the committee.

Mr. WILLIAMS. I base my question on this:

I have received evidence in the last 3 weeks that at least 1 Communist is presently teaching in 1 of our colleges—and I am quite certain there are probably more—on a grant from the National Science Foundation. I intend to go into that matter, of course, when Dr. Waterman appears before the committee.

Mr. PRICE. That would be a basic problem that exists under existing legislation. It would have to be solved at some other level, I think, rather than in this bill.

Mr. WILLIAMS. Thank you for an excellent statement.

Congressman Van Zandt, of Pennsylvania.

STATEMENT OF HON. JAMES E. VAN ZANDT, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF PENNSYLVANIA

Mr. VAN ZANDT. Mr. Chairman and members of the committee, the opportunity of appearing before this Subcommittee on Health and Science of the House Committee on Interstate and Foreign Commerce in behalf of my bill, H. R. 10464, is appreciated.

My bill, H. R. 10464, is a companion bill to H. R. 10456 introduced by my colleague, Hon. Melvin Price, of Illinois, chairman of the Congressional Joint Committee on Atomic Energy Subcommittee on Research and Development, of which I am ranking House Republican member.

Both of these bills result from lengthy hearings by the Joint Committee's Research and Development Subcommittee held in the spring of 1958 on the shortage of scientific and engineering manpower and our visit to Russia last fall as members of the Congressional Joint Committee on Atomic Energy.

Therefore, this is truly a bipartisan legislative effort.

Mr. Chairman, the Price-Van Zandt bills amend the National Science Foundation Act of 1950 in order to provide for certain educational programs which will improve mathematics instruction in our secondary schools as well as refresher courses and fellowships for mathematics and science teachers.

The legislation is designed to attack one of the greatest deficiencies to be overcome in this country, namely, that which exists in our secondary schools where a serious deterioration in the quality of mathematics instruction has taken place.

It is pretty well agreed that this deterioration in the quality of mathematics instruction has prevented many of our young people from pursuing college-level studies and careers in science and engineering.

To remedy this situation, the Price-Van Zandt bills provide that an award program be set up, with no strings attached, to provide a $500 scholarship to all high-school seniors who can pass an examination of prescribed difficulty in mathematics.

This program will serve not only to remedy the enormous annual waste of potential scientific talent but will help restore mathematics to its rightful place as a basic element of the high-school curriculum.

Mr. Chairman, at this point I would like to read into the record a very interesting statement taken from the May 11, 1958 issue of the New York Times. This is credited to a gentleman by the name of Garvin H. Dyer, president of the National Society of Professional Engineers, and I quote:

> A survey of recent high-school graduates showed that only 40 percent of the top one-third had gone beyond elementary artithmetic, and that almost one-fourth of the high schools did not even offer courses in geometry, physics, and chemistry.
>
> In 1900, he said, about 75 percent of high-school students studied algebra, compared with 25 percent in 1955. In 1900, 26 percent studied geometry, but in 1955 the number had declined to 12 percent. In 1900, he declared, 20 percent studied physics, while in 1955, only 5 percent did.

That is the end of the quotation.

This statement, of course, supports this provision of our bill which would provide a $500 scholarship to all high-school seniors who can pass an examination of prescribed difficulty in mathematics.

In addition to the scholarship program, another provision of the Price-Van Zandt bills provides a stepping up of the present summer institute program administered by the National Science Foundation by providing refresher courses for high-school mathematics and science teachers.

In this connection, the present program is handicapped by the fact that the National Science Foundation was only able to provide funds for 108 institutions last year on its relatively small budget of $5.3 million.

There were over 200 qualified institutions which proposed to set up summer institutes with the Foundation's cooperation but were unable to do so because of the lack of funds, since the $5.3 million available was wholly inadequate.

It is conservatively estimated that in addition there are at least 200 other qualified institutions in the country which would participate in the program if adequate funds were available.

Therefore the Price-Van Zandt bills increase the funds for summer institutes from $5.3 million to $25 million, thus making possible the quadrupling of the present summer institute program of the National Science Foundation as a concrete means of assisting high-school mathematics and science teachers by improving the quality of their instruction.

In addition to scholarships and the summer institute program, the Price-Van Zandt bills provide that there should be established by the National Science Foundation a program of summer fellowships for those high-school teachers who already have their A. B. degrees and who desire to increase their scientific knowledge.

The program, at a level of $7.5 million a year, will be a valuable supplement to the summer institute program and will provide the advanced training needed to stimulate and guide talented young people in our better schools. Then, too, it will provide the added advantage of improving the quality of instruction among teachers.

Mr. Chairman, the proposals made in the Price-Van Zandt bills, if translated into action, will be an important first step toward ensuring that this country will have an adequate supply of scientific and engineering talent to meet the scientific challenge of the future.

Moreover, if the intent of these bills is enacted into law the need will be met without creating serious imbalances in the social and economic fabric of this country by serving to strengthen the country measurably through improvements in the basic educational preparation we give to all our young people.

Mr. Chairman, the provisions of the Price-Van Zandt bills represent a means of meeting to a marked degree the Soviet challenge to American education, which we as members of the Joint Committee on Atomic Energy came in contact with last October in visiting Russia and talking with Russian scientists.

When Congressman Price and I returned to the United States last October, and after reviewing our observations in Russia, we concluded that no time should be lost in perfecting appropriate legislation to meet the Soviet challenge. As a result, we drafted the Price-Van Zandt bills. When we introduced them we made the following joint statement—and I would like to make that statement part of the record at this time.

Mr. WILLIAMS. If there is no objection, that will be done.

(The statement is as follows:)

JOINT STATEMENT BY REPRESENTATIVE MELVIN PRICE (DEMOCRAT, ILLINOIS) AND REPRESENTATIVE JAMES E. VAN ZANDT (REPUBLICAN, PENNSYLVANIA), CHAIRMAN AND RANKING HOUSE MINORITY MEMBER OF THE RESEARCH AND DEVELOPMENT SUBCOMMITTEE, JOINT COMMITTEE ON ATOMIC ENERGY, IN THE HOUSE OF REPRESENTATIVES ON MONDAY, FEBRUARY 3, 1958

MEETING THE NEED FOR SCIENTIFIC MANPOWER—AN INTELLIGENT APPROACH TO THE PROBLEM

We believe that the time has come, and in many respects is long overdue, for a forthright facing-up to the challenge presented to this country by the Soviets in their massive educational program aimed at outproducing the free world, both in quantity and quality, in the output of trained scientists and engineers.

We are witnessing a life-and-death battle for brainpower in an age of rapid technological advance. The penalty for losing this battle is Soviet domination

of the world and the destruction of our way of life as a free people. It is clear that we must act—and act promptly—to meet this threat. At the same time, we must not lose sight of our long-range objectives and adopt hasty measures which will jeopardize the attainment of these objectives.

This battle for brainpower is not new. Back in the spring of 1956 the Research and Development Subcommittee of the Joint Committee on Atomic Energy, mindful of the mounting threat to this country posed by the Soviet Union, held extensive public hearings on the shortage of scientific and engineering manpower. As members of the subcommittee, we believed then, and we continue to believe today, that concrete remedial action is needed urgently if we are to meet the Soviet challenge successfully.

Recent events, including Russian achievements in launching two earth satellites, serve to underscore this urgent need for action. We are faced not so much with a new situation as with dramatic proof of what many experts have been saying all along regarding the large-scale efforts of the Soviets to achieve technological mastery of the world. Our recent first-hand visit to Russia where we had an opportunity to talk directly with top Russian scientists has clearly confirmed these findings.

Since the advent of sputnik we have heard much in public forums and in the press about the need for "crash" programs to regain America's technological supremacy. We have heard proposals for stepping up scholarships in the individual scientific disciplines such as physics, chemistry, and biology and for channeling our young people into specific lines of activity within the scientific and engineering fields. These statements are reminiscent of the line of thinking which we ourselves indulged in prior to the subcommittee hearings in 1956.

As the hearings progressed, however, it became clear that only by attacking the roots of the manpower problem, not its surface manifestations, can we effectively meet future requirements. We recognized then, as we do today, that in our haste to "catch up" with the Russians there is a natural tendency to call for special-purpose legislation to cope with the pressing problems of the moment.

But the more we looked at the problem, the more we became convinced that the shortage of scientists and engineers is only part of a larger shortage of specialized talent in all fields, and that the best and surest means of meeting future requirements in the scientific and engineering fields is to increase the overall supply of specialized talent—across the board. Laying undue emphasis on any one specialized field of scientific endeavor, to the exclusion of others, would create serious imbalances which would in the long run only serve to undermine the very strengths we are attempting to build up.

In brief, we came to recognize that the shortage of specialized talent is total and that deficiencies exist in many areas which must be dealt with at the same time we are directing our attention to the scientific and engineering fields. Loading the deck in favor of one over the other is not only futile but may well be fatal to the long-term national interest.

It is clear, then, that any measures which are taken must be developed in the context of our overall needs and must serve to strengthen the Nation as a whole. This is not to say, however, that specific actions cannot be initiated now as part of a broad program of improvement, provided they contribute to our general long-term objectives.

Going to the roots of the scientific manpower problem, the subcommittee found that one of the greatest deficiencies to be overcome is the serious deterioration in recent years in the quality of mathematics instruction in our high schools. We found that through inadequate preparation in our secondary schools, particularly in the traditional subjects of mathematics, many of our young people who might be scientifically inclined are actually prevented from pursuing college-level courses in science and engineering. This represents an enormous annual waste of potential scientific talent which we can ill afford if we are to compete effectively with the Russians in the years to come.

Fortunately, this is one area in which concrete remedial action can and should be initiated immediately. We have been particularly impressed with the proposal originally made to the subcommittee at the 1956 hearings by Dr. I. I. Rabi, of Columbia University, that an award program be set up to provide a $500 scholarship to all high-school seniors who can pass an examination of prescribed difficulty in the traditional subjects of mathematics. There would be no strings attached to this award and there would be no requirement that the winners of such awards pursue a particular line of study, either in the scientific or other technical fields.

The advantages of such an award program are obvious. In the first place, it would help restore mathematics to its rightful place as a basic element of the

high-school curriculum through stimulating greater student interest in mathematics. An essential background would thus be provided for those intending to pursue scientific and engineering careers and at the same time the general curriculum would be strengthened for all students, whether or not they go on to specialize in these fields.

The award program would also serve as an indirect stimulus to parents and community groups to seek improvements in mathematics instruction in their own local high schools. Since the program would be on a purely voluntary basis it would not involve the problem of Federal control of local educational institutions. Major emphasis would still remain on action by local groups but a new incentive would be provided for such groups to take the necessary corrective measures. This, it seems to us, is a commonsense approach to the problem and one which would achieve tangible results without upsetting delicate social and economic balances in this country.

Intimately allied with interesting young people in science, is the caliber of the science teachers they have in high school. Without good teachers, well equipped with knowledge of recent developments in the scientific field, there will be no stimulus for students to excel in their subject, no one to alert youthful imagination to the challenges of the scientific frontier. It is difficult to calculate the influence good teachers have had in helping produce our scientific and other leaders of today, but no one would question that it has been substantial. Do we dare embark upon the future without assuring ourselves that we are doing everything possible to provide our young people with the best teachers available to prepare them for what lies ahead?

But good teachers don't just happen. Incentives must be provided to attract young men and women of high intellectual caliber to the teaching profession. Once they are recruited, they must be continuing incentives provided to keep them in the profession. The question then arises: What form should these incentives take?

As in the case of improving the high-school curriculum, much depends on the initiative and resourcefulness of local communities, particularly with regard to increasing teacher salaries, which in many areas are shockingly low. But beyond this, some means must be devised through which the Federal Government can lend assistance in cooperation with local authorities. Once again, this Federal assistance would have to be provided in such a way as to avoid undue interference with local school boards and State authorities.

Perhaps the greatest need at the moment is to provide high-school teachers with the opportunity to improve their own knowledge of their subjects and thereby improve the quality of instruction offered their students. This applies to teachers of all subjects, but the need for improvement has become particularly critical in the case of mathematics and science teachers.

One of the most successful means to date of meeting this need has been the summertime refresher courses for high-school teachers which have been held for the past several years under the auspices of the National Science Foundation. Through the cooperation of universities and institutions throughout the country, hundreds of teachers have attended special summer courses which average about six weeks in duration. Stipends of $75 per week are offered, together with $15 per dependent. The cost of running the courses is borne mutually by the Foundation and the participating university.

While the program is excellent as far as it goes, it does not go far enough on its present limited budget to meet mounting needs. For example, the Foundation was able to provide funds for 108 institutions last year on its relatively small budget of $5.3 million. However, there were double that number of qualified institutions who proposed to set up summer institutes with the Foundation's cooperation but were unable to do so because of lack of funds. It is conservatively estimated that in addition to this, there are at least 200 other qualified institutions in this country who have not made specific proposals to the Foundation but who might be encouraged to join the program if funds were made available.

We therefore propose, as a concrete means of assisting high-school math and science teachers and improving the quality of their instruction, that the present summer institute program of the Foundation for high-school teachers be quadrupled in size and that the present funding level for the program be increased from $5.3 million to $25 million. Chief value of such action would be to take an already going concern and through expanding its activities, increase the number of teachers being assisted with a minimum of delay and a maximum of effectiveness.

In addition to the above program, we believe a new program should be established by the foundation to provide summer fellowships for those high school teachers who already have their bachelor of arts degree but who desire to increase their scientific knowledge. Such a program—at a level of $7.5 million per year—should be a valuable supplement to the summer institute program and should provide the advance training which some of our teachers need to stimulate and guide talented young people in our better schools. It would have the added advantage of helping bring up the quality of instruction among teachers all the way up and down the line and would place a premium on competence.

It is our conviction that the proposals we have made, if translated into action, would be an important first step toward insuring that this country will have an adequate supply of scientific and engineering talent to meet the scientific challenge of the future. They will help meet this need, moreover, without creating serious imbalances in the social and economic fabric of this country. They will, in fact, serve to strengthen the country measurably by providing improvements in the basic educational preparation we give to all our young people. This is the true answer to the Soviet challenge and in keeping with the best traditions of our free society.

We are today introducing legislation in the House to carry out these proposals. We are hopeful it will receive prompt and favorable consideration.

Mr. VAN ZANDT. Mr. Chairman, it was my privilege to address the annual meeting of the Pennsylvania Secondary School Principals Association at Harrisburg, Pa., on October 29, 1956, almost a full year before Sputnik I was launched.

My address was based in considerable measure on hearings held in 1956 by the Subcommittee on Research and Development of the Joint Committee on Atomic Energy, of which I am a member.

These hearings delved in considerable detail into the reasons for the shortages of scientific and engineering manpower and showed conclusively that the deficiencies of our educational system are the fundamental reason for this shortage. Actually the crucial shortage is not that of scientists today. It is today's and tomorrow's shortage of talented teachers.

As experts testified in the course of these hearings the progress made in science and technology, in such fields as nuclear weapons, jet propulsion, radar, plastics, and electronic computers, has been so great that our educational system as a whole has lagged.

Compared to today's needs our elementary and secondary schools, and even many of our colleges, are living in a horse and buggy era.

Nearly 2 years ago these hearings revealed, and I repeated in my Harrisburg, Pa., speech, that the Russians are training intensively about three times as many scientists as we are; that by 1960 every Russian child in the Soviet 10-year school program will have to study 5 years of physics, 5 years of biology, 4 years of chemistry, 10 years of mathematics through trigonometry, and 1 year of astronomy.

I told my Harrisburg audience in October 1956 that not only are the Soviets training engineers at a rate three times as fast as we are, but, despite the fact that their own industrial capacity is only half the size of ours, they are sending scores of these engineers into other lands, engineers who will, of course, help convert these lands to communism.

And, may I add at this point, we found out in Russia last fall that in addition to engineers, Russia is sending scientists, in many cases nuclear scientists, into all of the nations of the world, including the free nations; and today you will find as a member of the staff of the embassies and consulates an attaché with a scientific background.

In December 1955, Khrushchev and Bulganin offered to build and staff a technological institute in Rangoon, "a gift to the people of Burma from the people of the Soviet Union," as they put it. The

following year Russian technicians started building a steel mill for the Indians in India. Enticing inducements have been advanced to Egypt, Afghanistan, and Latin America.

I warned my Harrisburg audience that this type of penetration by the Soviets may be expected to grow rather than wane as the supply of trained Russian personnel becomes ever greater. As I have stressed again and again, we must not allow ourselves to fall behind the Russians. If this ever happens we could easily find ourselves outwitted, outmaneuvered, outthought, and outbuilt throughout the world.

I continued by saying that as never before we know the key to our continued leadership in the free world lies in our schools. Therefore, there is no project in the Nation that should have a higher priority than the rapid improvement of our educational facilities. The teacher shortage is desperate and must be dealt with aggressively.

This problem cannot be solved on the present basis of recruitment, preparation, and utilization of teachers. The problem of the teacher shortage must be attacked on many fronts. Local communities and States must face up to the fact that this is their problem and must provide the tax support required. Teachers' salaries must be increased to attract more capable persons into the profession. Greater incentives and rewards for outstanding teachers should be provided. Teachers can be relieved of a good many routine housekeeping and clerical chores.

Ways must be found, as I told the convention of Pennsylvania secondary school principals in October of 1956—

to make sure that our teachers receive the recognition and the prestige which is commensurate with their high responsibility of training our young people.

We must also make certain that we obtain more thorough means of identifying talent and more effective guidance for our young people.

The need is great and it is immediate. The future of America lies not just in the hands of its educators. The burden of responsibility for America's future lies upon all of our citizens. We must lift ourselves to a new and higher plane of concern, of hard work, of expenditure, and of dedication to the increased development and undergirding of America's key to the future, our educational system.

Mr. Chairman, let me repeat again that what I have read to represents excerpts from my speech in Harrisburg, Pa., in October 1956.

In calling my views to your attention, I do not pose as an expert in the field of education. I share, however, the concern you and all other Americans have in our educational system which we like to think is the best in the world.

My views are based on the lengthy hearings of 1956 by the Joint Committee on Atomic Energy, my visit to Russia last fall, and my great desire to enable the United States to meet the Soviet challenge to the American educational system.

Therefore, I sincerely hope that the Price-Van Zandt bills will receive your favorable consideration.

That concludes my statement, Mr. Chairman.

Mr. WILLIAMS. Thank you very much, Mr. Van Zandt.

Mr. Loser?

Mr. LOSER. I have nothing, Mr. Chairman.

Mr. WILLIAMS. Dr. Neal?

Mr. NEAL. No questions.

Mr. WILLIAMS. Mr. Van Zandt, may I ask one question—and this concerns me greatly.

No doubt the authors of all of these bills are very sincere in their desire to promote technical and scientific education in the United States; and that, of course, is desirable. However, as Members of Congress, as you know, we are limited by our oaths to support and defend the Constitution, which limits our authority.

Your bill, along with that of Mr. Price, provides for Federal funds to be expended in the field of secondary public education.

I am very much concerned over the compatibility of that principle with the meaning and intent of the Constitution. What in the Constitution authorizes the expenditure of Federal funds for that purpose?

Mr. VAN ZANDT. I cannot exactly place my finger on that part of the Constitution from which would stem the authority. But I do take the position that when a problem exists that cannot be met by the local communities and the State, then it becomes the responsibility of the Federal Government.

And in my thinking today, the problem that we have analyzed here that exists in the field of education, especially in the scientific and engineering field, is a Federal Government responsibility, and it is for that reason that we think that the Congress should consider such proposals and do something about it.

Mr. WILLIAMS. Of course, I did not ask the question for the purpose of attempting to argue with the witness. But I am very much concerned over our constitutional authority for the expenditure of Federal funds for purposes not specifically mentioned in the Constitution. And in view of article X of the Constitution, as I interpret it, we are limited in our power to tax and spend.

I presume that the basis for this legislation is to be found in the general welfare clause in the preamble of the Constitution. Assuming that to be true, then might it be said also that there is no limit on the power of the Federal Government if we are to legislate in every field where the Congress feels that such legislation is in the interest of the general welfare?

Mr. VAN ZANDT. Of course, we function here in Congress many times on precedents. One of our staff members just reminded me that it was this committee that conceived and firmed-up what is now the National Science Foundation. Of course, it operates under that provision of the Constitution that has to do with the health and welfare of the American people.

Mr. WILLIAMS. Without attempting to brand that act as wrong which I shall not, nevertheless assuming that it was wrong in the first place, then two wrongs do not necessarily make a right; do they?

Mr. VAN ZANDT. That is true. But I think that the events since the enactment of the National Science Foundation statute prove definitely that the Federal Government has a responsibility in this field.

We see it day in and day out as we sit as members of the Joint Congressional Committee on Atomic Energy. We are briefed as to what Russia is doing, and we know our own problem. It is with this background that Congressman Price and myself come here this morning and sponsor the type of legislation we do.

Mr. WILLIAMS. Getting to another subject, I was very much interested in the figures you gave the committee a few minutes ago as to the small number of students who study mathematics in high school.

I recall when I was in high school—and I will not say how long ago that was, but relatively it was not too long ago—certain subjects were required subjects, and all the students that went through with me studied algebra and geometry. We had to have one class of science, I believe, so many hours or credits of science and English composition and other required subjects.

Do you know for a fact that that course is not being followed now, and that students are being permitted to be selective in their choice of subjects?

Mr. VAN ZANDT. The article I read a moment ago was taken from the New York Times, and represents a quotation by a gentleman who was speaking for the National Society of Professional Engineers. He did not reveal the source of his information. But based on other information that has been made available, I am inclined to believe that the word "selective" that you mentioned a moment ago prevails today throughout our educational system.

I think it is a loophole through which and by which many individuals bypass this important field that eventually leads one into science.

Mr. WILLIAMS. I do not know whether this is true or not, but I think if our high schools have abandoned their old practice of having certain required subjects, they are making a tremendous mistake. I am inclined to feel that our problem could be met as well there as it would be in attempting to provide an incentive to students to study those courses.

I am inclined to believe that this problem should be approached from the standpoint of attempting to revise courses, methods of study in our high schools.

Dr. Neal, do you have any questions?

Mr. NEAL. I think, Mr. Chairman, you have brought out a very important point here.

Is it not true, Mr. Van Zandt, that inasmuch as we are assuming, as the curriculum of the public schools has been permitted to go to the extent where it is recognized that the student can elect what he wants to study, that very fact has resulted in the downgrading of the efficiency of the teachers in public schools today?

I would say from my former knowledge of teaching—and I taught for a period of 6 years—that most any ambitious teacher, regardless of the fact that he has not been especially trained to teach mathematics, has the ability on his own to improve himself to the point where he can take up the teaching of mathematics and perform it successfully.

I look upon this whole situation with a view point that our lack of teaching ability and the lack of numbers of individuals in high schools who take up the opportunity to study these subjects of languages and higher mathematics are largely due to the fact that there has not been any incentive.

Mr. VAN ZANDT. That is right.

Mr. NEAL. To me, the whole solution of the problem of this overall picture depends upon how successful we are in revising the required curriculum in our high schools. I think a solution such as you offer, giving scholarships, may have an immediate effect. But in so doing, you are establishing a custom which will naturally tend to lead students

throughout the future to believe that their education must be financed by the Federal Government, rather than by the local communities. To me, that is where we are making our mistake.

Unquestionably, the local communities must bear the expense, whatever it may be, in the form of tax, that would be entailed in these systems of education. If the local communities and the local individuals have enough incentive to want to do it on their own, undoubtedly it can be done with fewer dollars than it can be done if the process eventually resolves itself into the Federal Government's taking over the whole thing.

Mr. VAN ZANDT. I agree with the gentleman. It is a responsibility of the local community.

However, I am reminded of an experience I had last October, just a few days after returning from Moscow. It was my privilege to address a high school in my district, talking for 45 minutes, principally on education as we observed it in Russia. Upon the conclusion of the 45-minute period, one of the classes was told to go back to their study room. About an hour later, that same class was brought back into the auditorium, and they asked the privilege of questioning me, which I granted them with a lot of pleasure.

This was the gist of their questions: What can we do to meet this challenge?

Luckily, several of the school directors were there, members of the school board. Some weeks later, the school board took it upon themselves to rearrange the school curriculum by including in it those items necessary to meet the challenge.

It was all brought about by a presentation of facts based on our observations. I take from this experience—and I have had similar experiences elsewhere—if the American people are fully informed of this challenge at the local level and especially the members of the school board, they will rearrange the curriculum of their schools, and in the years ahead of us we will have the type of scientists necessary to compete with Russia throughout the world.

Mr. NEAL. I agree with you that that is where we have to begin; and I do not like the idea that prevails in our educational system or whatnot that we must follow the path of Russia. Russia is a dictatorial nation. Russia has complete control, complete power, complete domination of all resources. Here in a democratic country we assume that from the bottom we have that power in our own setup. To progress more and more toward the idea of the Federal Government's participating in things that the people at home ought to be responsible for primarily is a way of leading us gradually and more closely toward the form of government that prevails now in Russia.

It would seem to me that in all these things we should avoid just as far as possible assuming public, Federal obligations for things that people at home ought to do. If we have been faulty and if we have neglected our education, it is up to us to arouse the local people as to the facts, just as you state you did over in the Harrisburg high school. And when they know the facts, I think the people are capable and I think they are willing financially to support the improvement that is essential to bring about an educational system here that will eventually meet the requirements in higher education, including engineering.

Mr. VAN ZANDT. Of course, the Price-Van Zandt bill is designed to offer incentives to the young men and women of the country, and also

to sharpen the ability of the teacher. We think this is a responsibility of the Federal Government. But I agree that education must have its control and its arrangement at the local level.

Mr. NEAL. Mr. Van Zandt, do you believe that if we had some form of Federal loan setup which would provide opportunities for bright students who are able to qualify but unable to continue financially themselves, we might interest a different class, a more ambitious class of young students than if we were to give them the outright scholarships?

Mr. VAN ZANDT. I think today we have a pattern in our way of life. It is not so much Government as it is industry, through foundations and so forth. I think if this type of program or pattern is broadened, we could do the very thing that you suggest, and that is, attract more young men and women who cannot afford to go into schools of higher education.

I think it can be done without the Government paying the bill.

Mr. NEAL. I think you are right.

Thank you, Mr. Van Zandt.

Mr. WILLIAMS. Mr. Van Zandt, most of this clamor for granting incentives to youngsters to study science and go into the scientific fields arose as a result of Russia's launching of the first satellite. Is that not true?

Mr. VAN ZANDT. That is right; yes.

I must refer again to the fact that the subcommittee, headed by Mr. Price, of the Joint Congressional Committee on Atomic Energy, back in 1956, detected this weakness, and at that time we requested various agencies of Government to do something about it. We called upon organizations and schools, and so forth. It took Sputnik I, however, really to arouse interest.

Mr. WILLIAMS. I am wondering, though, if we are behind Russia in the field of scientific development, or if we are behind Russia only in the field of governmental scientific development.

To try to clarify that, I was in Russia in 1955, I believe it was. I noticed that the automobiles in Russia were generally 10 years behind ours in development, and there were very few of them.

Mr. VAN ZANDT. They are still 10 years behind.

Mr. WILLIAMS. I went into a home in Russia. I saw one electric light dropped from the ceiling on a drop cord. They were using a wood stove, an old wood stove that looked very much like the old Home Comfort wood range. They had a well in the backyard, although this was an urban community, so to speak, a little town of about 1,000 people. I did not see any electric refrigerators. I saw very few television sets in Russia, and those that I did see were in development at least 6 or 7 years behind ours. I saw no electric washing machines. I saw no garbage disposals, for instance. I saw very few of the things that we take for granted here in the United States. Also, I saw no modern, up-to-date highways in Russia.

Perhaps I went to the wrong places. I do not know. Maybe you saw those.

I am just wondering if perhaps in Russia, because of their form of government, they are ahead of us in the satellite field or the nuclear physics field—I doubt whether they are in the latter; but I do know you are better equipped to inform us of that than I am—because their government has channeled those activities and scientists to those particular fields, but in so doing they have neglected another field of

scientific development where we have excelled. I am wondering whether this problem is quite as acute as it has been presented to us.

Mr. NEAL. May I suggest a point there?

If we were to direct the engineering potential that we have in the United States today toward the field of atomic research, would we not after all be superior in numbers of scientists engaged in that activity as compared to Russia today?

Mr. VAN ZANDT. Mr. Chairman, there is quite a difference in Russia today. Your visit was in 1955; our visit was in 1957. The subcommittee of which I was a member deliberately studied the scientific effort on the part of Russia, principally in the field of atomic energy, which provided us with a glimpse of medicine and military as well as the general industrial effort of Russia.

Senator Gore, of Tennessee, who was a member of the committee, made this statement: He said:

> They cannot build bathtubs and buildings, but they can certainly build electronic devices, bombs, and so forth.

Now, let us see what they are building.

I think I can best explain Russia's development in the scientific field by spending a minute on describing the International Nuclear Institute located at a place called Dubna, which is about 90 miles north of Moscow. The entire community is devoted to scientific effort, approximately 10,000 people. Living there with families are 275 of the best physicists that Russia could gather from one-third of the earth's surface. Of that number, 175 were from her satellites, with the exception of 1 from Italy and 1 from France. The remaining 100 were Soviets.

We saw at Dubna, in three operational areas, some of the most modern laboratory equipment, electronic devices, and so forth, in the world. We had experts with us. We had some experience in this field ourselves, and while it was no better than we have, yet it was just as good.

They have a syncocyclotron which takes about 10 billion volts of electric energy, the largest of its kind in the world.

When you study this development as we did, you cannot help but say they may not be able to build buildings and bathtubs, but they certainly can build electronic devices, and that their progress in the field of atomic energy is somewhat comparable to ours. In some fields they may be a little ahead of us; in others, we are ahead of them. But we feel they are comparable to us.

We looked at their hospitals, as I have said. Their buildings are crude, the equipment is crude, such as the tables and chairs; but when it comes to the instruments needed by the doctor, they are just as good as ours. Their medicine is some years behind ours.

We looked at their farm machinery. They have laid aside the massive, crude equipment they were building in the past, and now they are falling more in our footsteps. As a matter of fact, many of the innovations of our farm-equipment industry we saw in Russia.

We looked at their automobiles, the small European-type car. They have gone in for colors as we have. They are now using plastics for the interior decoration, and many of the ideas that our automotive industry uses, Russia uses today.

Mr. NEAL. In other words, you think, Mr. Van Zandt, they have been very successful in copying many of the things that the American people have developed?

Mr. VAN ZANDT. That is correct. We saw it not alone in their automobiles. We saw it in their farm equipment, in their railroad equipment, in their maritime equipment, as we moved through these various industries.

One of the items attracting our attention was the chart one finds in almost every factory, a graph on the wall, showing the progress they have made in the last few years toward a goal they have established. In each instance, it was climbing rapidly. It is an accepted fact they are improving their industrial production by about 10 to 11 percent annually.

Behind the crude way of living, Mr. Chairman—and we agree with what you saw—we found these developments and I think they are a threat, a definite threat not only to the United States, but to the other free nations of the world.

Sputnik I, I think, made a contribution to our way of living, because it revealed to the world some of the things we saw in Russia and about which we are talking.

Mr. NEAL. And we have to admit that their engineering superiority, if they have any at all, is not primarily their own, but purely an adaptation of engineering discoveries and creations that originated in the Western World, primarily.

Mr. VAN ZANDT. Basically, that is right. I think if you go back a few years, you can recall we moved an entire steel mill over there, rebuilt it for them. We took automobile plants to Russia and rebuilt them, trained their engineers, and so forth. So basically, that is right.

But I think today they are standing on their own feet, and I think it can be charged to the dictatorial method they employ in education. They direct their young men and women to follow this or that route in the field of education, and the teacher of any of the schools is recognized as a spokesman for the Communist Party, which dominates the Russian Government. When she or he points a finger at a student, that is communism pointing a finger. The discipline in the schoolroom was truly something.

Mr. WILLIAMS. To what extent, Mr. Van Zandt, if you know, did interned German scientists contribute to the development of sputnik and some of these other highly advanced developments?

Mr. VAN ZANDT. Immediately after the war, when Germany collapsed, Russia confiscated laboratory equipment, all the records of the laboratory, and some finished and unfinished products such as bombs, submarines, and so forth. All this was moved back into Russia proper. In addition, of course, they took the engineers who were not permitted to become part of any organized effort of a specific project. They were generally relegated to an area far beyond the location of the project itself. So, unknown to each individual engineer, his efforts to develop this or that project was a contribution to the ultimate project.

The Russians took from the German scientist or engineer all of that knowledge that they could get from him, and then scattered the group about Russia for a year or more before returning them to Germany.

In reply to our questions in Russia concerning these Germans, we found while they were given some credit, yet the credit does not amount to much. Russia points to her scientists and her engineers as the basis of the development she speaks about—and brags about today.

Mr. WILLIAMS. Are there any further questions?

Mr. LOSER. I have nothing, other than to say to my colleague, Mr. Van Zandt, that he has made a very fine statement, and I think the time that he spent in Russia has been quite beneficial to the Nation, in the information that he has brought back and presented to the people of the United States.

Thank you so much.

Mr. VAN ZANDT. May I make a concluding statement:

One of the greatest contributions that could be made to the future of this country would be for every Member of the United States Congress to go to Russia and see for themselves what we saw. We specialized in the field, atomic energy, and we came back with a different picture entirely of Russia, and it has helped us considerably in legislating.

I say again every Member of Congress should be permitted to visit Russia as we did.

Mr. WILLIAMS. It would certainly intensify their appreciation of the United States. I agree with you, sir.

At this time we are pleased to welcome our friend and colleague from Illinois, Congressman Dawson, the author of one of the bills before the committee, which as I understand it provides for a different approach in meeting this problem.

STATEMENT OF HON. WILLIAM L. DAWSON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS

Mr. DAWSON. I certainly have been favored to be present to listen to that dissertation by Mr. Van Zandt. I think it was very, very timely and very, very much appreciated.

Mr. WILLIAMS. You may proceed.

Mr. DAWSON. Mr. Chairman and members of the committee, I wish to express my deep appreciation for the opportunity you have given to me and to other interested persons to express our support of H. R. 10293, a bill to establish a national scientific research reserve fund.

First, let me briefly outline the major provisions of H. R. 10293:

In essence, the bill provides for the establishment of a continuing reserve fund of not less than $200 million for the support of basic and applied research projects in instances where the executive committee of the National Science Board finds that the initiation or continuation of the projects is of sufficient importance and urgency to justify an immediate expenditure without carrying out the usual budgetary and appropriation procedures. Accountability would be preserved by requiring periodic reports to Congress on expenditures and accomplishments.

It is important to note that the proposed fund is not designed to replace existing agency research budgets. Rather, it would be in the nature of an emergency fund for the initiation or continuation of urgently needed research in any field of science. It should also be noted that the bill does not contemplate that $200 million would necessarily be expended from the fund each year. That amount, or a

greater amount appropriated by Congress, would be the maximum available in any one fiscal year, provided that the expenditure standards were met.

Where a project does qualify under those standards, the bill contemplates that the grant made would be adequate to enable the project to be pushed vigorously forward along well-planned lines. In other words, when the need is shown, the bill does not limit the grants to mere stopgap measures.

The bill also provides that any moneys which may be received by the United States as a result of projects wholly or partially financed by the fund, shall be paid proportionately into the fund. This clause does not change any existing law or regulation relating to patents secured as a result of federally financed research.

H. R. 10293 was drafted after discussion with a number of leading scientists and educators had developed the great need for such a reserve fund in order (1) to provide for the rapid initiation of important research projects without the usual programming and budgeting delays and (2) to provide continuity for valuable projects which may be threatened by lack of funds. It is well known that time lags in the approval and budgeting of projects and discontinuities in project operations have seriously affected the Nation's scientific efforts. This bill, I believe, will help materially in overcoming difficulties of this nature and in furthering our Nation's research activity.

H. R. 10293 has the overwhelming support of the country's leading scientists and educators. I understand that your committee has received literally hundreds of letters urging enactment of the measure. I have received almost a hundred letters favoring the bill from members of the National Academy of Sciences and from university presidents throughout the country.

Some of these are copies of letters sent to your committee, but many have been addressed to me. For the convenience of the committee, I shall with your permission file for the record a list of the outstanding men who have expressed support in communications to me and also those letters which have been addressed to me personally.

Mr. WILLIAMS. Is that material appended to your statement?

Mr. DAWSON. Yes.

Mr. WILLIAMS. The committee will be glad to receive that material.

(The material is as follows:)

MARCH 25, 1958.

PARTIAL LIST OF LEADING SCIENTISTS AND EDUCATORS WHO HAVE EXPRESSED SUPPORT OF H. R. 10293, A BILL TO ESTABLISH A NATIONAL SCIENTIFIC RESERVE FUND

Dr. Charles G. Abbot, Smithsonian Institution, Washington, D. C.
Dr. Roger Adams, department of chemistry and chemical engineering, University of Illinois
Dr. Louis W. Alvarez, associate director, Radiation Laboratory, University of California
Very Rev. J. Joseph Bluett, S. J., president, St. Joseph's College, Philadelphia Pa.
Dr. Carl W. Borgmann, president, University of Vermont
Dr. George A. Bowman, president, Kent State University, Kent, Ohio
Dr. Gregory Breit, professor of physics, Yale University, New Haven, Conn.
Dr. Harrison Brown, geological sciences, California Institute of Technology
Dr. A. F. Buddington, department of geology, Princeton University, Princeton, N. J.

Dr. V. Bush, Chairman, Massachusetts Institute of Technology
Dr. John Chipman, department of metallurgy, Massachusetts Institute of Technology
Dr. Felton G. Clark, president, Southern University, Baton Rouge, La.
Dr. G. M. Clemence, president-elect, Rutherford Observatory, Columbia University, New York
Richard L. Conolly, Admiral, USN (retired), president, Long Island University
Dr. R. B. Corbett, president, New Mexico College
Dr. D. H. Dalluge, department of physical science, Illinois State Normal University
Dr. P. Debye, department of chemistry, Cornell University, Ithaca, N. Y.
Dr. Burgin E. Dossett, president, East Tennessee State College
Dr. Lester R. Dragstedt, chairman, department of surgery, University of Chicago
Dr. L. C. Dunn, professor of zoology, Columbia, University, New York
Dr. William J. Dusel, San Jose State College, San Jose, Calif.
Dr. John T. Edsall, Harvard University, Cambridge, Mass.
Dr. Herbert M. Evans, University of California
Dr. Paul J. Flory, executive director of research, Mellon Institute, Pittsburgh, Pa.
Dr. Paul D. Foote, chairman, Engineering Section, National Academy of Sciences, Washington, D. C.
Dr. Raymond W. Fuoss, professor of chemistry, Yale University, New Haven, Conn.
Dr. T. Keith Glennan, president, Case Institute of Technology, Cleveland, Ohio
Dr. David T. Griggs, professor of geophysics, University of California
Dr. Gaylord P. Harnwell, president, University of Pennsylvania
Dr. R. W. Harrison, vice president and dean of faculties, University of Chicago
Dr. Richard A. Harvill, University of Arizona
Dr. Sterling B. Hendricks, Chief Chemist, United States Department of Agriculture, Agricultural Research, Beltsville, Md.
Dr. David D. Henry, president, University of Illinois
Rev. Theodore M. Hesburgh, CSC, president, University of Notre Dame, Notre Dame, Ind.
Dr. Ernest R. Hilgard, professor of psychology, Stanford University, Stanford Calif.
Dr. J. O. Hirschfelder, director, University of Wisconsin
Dr. W. V. Houston, president, the Rice Institute, Houston, Tex.
Dr. J. C. Hunsaker, department of aeronautical engineering, Massachusetts Institute of Technology, Cambridge, Mass.
Dr. Eldon L. Johnson, president, University of New Hampshire
Dr. Robert L. Johnson, president, Temple University, Philadelphia, Pa.
Dr. E. N. Jones, president, Texas Technological College
Dr. A. N. Jorgensen, president, University of Connecticut
Dr. Berwind P. Kaufmann, senior staff member, resident investigator, department of genetics Carnegie Institution of Washington, Long Island, N. Y.
Dr. Lawrence A. Kimpton, chancellor, University of Chicago
Dr. George H. Lee, director of research, Rensselaer Polytechnic Institute, Troy, N. Y.
Dr. S. C. Lind, consultant to the Union Carbide Corp., Oak Ridge National Laboratory, Oak Ridge, Tenn.
Dr. Ernest Mayr, Museum of Comparative Zoology, Harvard College, Cambridge, Mass.
Dr. Donald H. Menzel, director Harvard College Observatory, Cambridge, Mass.
Dr. H. J. Muller, Indiana University
Dr. Walter H. Munk, professor of geophysics, University of California
Dr. S. M. Nabrit, president, Texas Southern University
Dr. L. Mark Neuberger, acting president, Utah State University
Dr. Robert F. Oxnam, president, Pratt Institute, Brooklyn, N. Y.
Mr. J. R. Pierce, Bell Telephone Laboratories, Murray Hill Laboratory, Murray Hill, N. J.
Dr. K. S. Pitzer, dean, University of California
Dr. R. F. Poole, president, Clemson Agricultural College, Clemson, S. C.
Dr. Tom L. Popejoy, president, University of New Mexico
Dr. Norman F. Ramsey, Department of Physics, Harvard University, Cambridge, Mass.
Dr. Roland R. Renne, president, Montana State College
Dr. Bruno Rossi, professor of physics, Massachusetts Institute of Technology
Dr. Frederick Seitz, head of the department of physics, University of Illinois

Mr. W. Shockley, Shockley Semiconductor Laboratory of Beckman Instruments, Inc., Mountain View, Calif.
Dr. George N. Shuster, president, Hunter College, New York, N. Y.
Dr. Hans Simons, president, The New School, For Social Research, New York, N. Y.
Dr. Louis B. Slichter, director, University of California
Dr. Philip E. Smith, department of anatomy, Stanford University, Stanford, Calif.
Dr. Charles P. Smyth, department of chemistry, Princeton University, Princeton, N. J.
Dr. Robert G. Sproul, president, University of California
Dr. Francis J. Turner, professor of geology, University of California
Dr. Victor C. Twitty, executive head, department of biological sciences, Stanford University, Stanford, Calif.
Dr. Donald D. Van Slyke, Brookhaven National Laboratory, Associated Universities, Upton, Long, Island., N. Y.
Dr. Ernest H. Vestine, Pacific Palisades, Calif.
Dr. Maurice B. Visscher, department of physiology, University of Minnesota
Dr. Harold C. Urey, University of Chicago
Dr. F. W. Went, California Institute of Technology
Dr. John A. Wheeler, Palmer Physical Laboratory, Princeton University, Princeton, N. J.
Dr. George H. Whipple, University of Rochester, School of Medical and Dentistry, Strong Memorial Hospital, Rochester, N. Y.
Dr. Robert R. Williams, Summit, N. J.
Dr. Alan S. Wilson, president, Hillyer College, Hartford, Conn.
Dr. Hans A. Bethe, Laboratory of Nuclear Studies, Cornell University, Ithaca, N. Y.
Dr. William W. Bloom, chairman, department of biology, Valparaiso University, Valparaiso, Ind.
Mr. Richard Brauer, president, American Mathematical Society, 190 Hope Street, Providence, R. I.
Dr. Ralph W. Chaney, professor emeritus, department of paleontology, University of California
Dr. Donald F. Hornig, professor of chemistry, Frick Chemical Laboratory, Princeton University, Princeton, N. J.
Dr. M. King Hubbert, 3737 Bellaire Boulevard, Houston, Tex.
Mr. F. Leister, vice president, I/C Engineering, Fafnir Bearing Co., New Britain, Conn.
Dr. Joseph E. Mayer, University of Chicago, Chicago, Ill.
Dr. Frederick D. Rossine, Silliman professor and head, department of chemistry, Director, chemical and petroleum research laboratory, Carnegie Institute of Technology, Pittsburgh, Pa.
Dr. L. I. Schiff, executive head, department of physics, Stanford University, Stanford, Calif.
Dr. Owen T. Smith, Trinity College, Hartford, Conn.
Dr. W. M. Stanley, Virus Laboratory, University of California
Dr. A. L. Strand, president, Oregon State College, Corvallis, Oreg.
Dr. Carl S. Vestling, professor of biochemistry, University of Illinois, Urbana, Ill.
Dr. Theodore Von Karman, AGARD Pallais Chaillot, Paris 15, France.

Mr. DAWSON. The word partial is used in the title of the list because I have been informed that many others have written to your committee in support of the bill. There are also included, for your information, the very few letters which do not fully back the measure.

Extensive quotations from these letters would be very illuminating but also quite repetitious. You gentlemen will, I am sure, give careful consideration to the views expressed in the correspondence you have received. You may be sure that the thoughts of such men as Dr. Sproul, president of the University of California; the Reverend Hesburgh, president of the University of Notre Dame; Dr. Houston, president of Rice Institute; and Dr. Henry, president of the University of Illinois, to name just a few, are much more significant in this matter than are my own.

I would, however, like to repeat a statement made by L. V. Berkner, president of Associated Universities, the agency which operates the Brookhaven National Laboratory for the Atomic Energy Commission. On January 28, 1958 in testifying before the Government Operations Committee on the budgetary and organizational aspects of scientific research, Dr. Berkner said:

> Certainly, the proposal * * * that a $200 million scientific research reserve fund be established "to permit highly desirable and carefully selected scientific basic and applied research projects to be started or to be continued without lengthy delays" has a great deal of merit. Such a fund, skillfully administered and employed by and appropriate agency such as the National Science Foundation, would be invaluable in stabilizing research projects that had reached a critical stage in their growth. Such a fund would save millions for the country by preventing destruction of costly research effort before it reach fruition, and the scientific stature of the Nation would be greatly enhanced by ensuring that individual researches were brought to their logical conclusion. Above all, such a fund would encourage our most brilliant scholars of science to work in the field of basic research with the confidence that years of work would not be wasted and hopes frustrated by some arbitrary fiscal decision.

It is essential that we in Congress realize, and bring home to the American people, that in the Mideast and elsewhere, the United States is engaged in a struggle just as desperate and just as deadly as when our forces faced those of Hitler across the African deserts. Perhaps today the horrible instruments of mass destruction have counterbalanced and neutralized the weapons of war as we have traditionally known them. The weapons of our immediate time are new ideas, new economic, political, and with emphasis, new scientific concepts.

One great advantage the totalitarian countries have had in this phase of the struggle is the ready availability of funds to begin important new scientific projects and to exploit breakthroughs quickly. We in the United States must have the imagination and determination to devise and adopt methods, consistent with our democratic processes, to meet this challenge. The bill now before this committee will help immeasurably in providing the necessary fiscal flexibility to make funds available quickly for salaries, materiel, and facilities.

H. R. 10293 is, of course, not a panacea. It will not solve all our organizational or even all our budgetary problems. It will, however, provide an effective and much-needed tool to encourage and speed up our national research efforts. Its grassroots support demonstrates vividly the stimulation it will give to the men who actually work in our laboratories and universities.

In conclusion, it should be noted that the national scientific research reserve fund as established by H. R. 10293 will fit readily into any foreseeable reorganization of Federal scientific agencies. The fund could be administered just as well by a Department of Science or a Science Commission as by the National Science Board. Enactment of H. R. 10293 should not be delayed because of such contingencies. While the fund will have its place, and a very necessary place, in any organizational structure Congress may ultimately establish, it is badly needed right now.

Following that is a list of the men who appeared and testified, and I would like to leave with you and introduce the letters received by me personally in support of this measure, as well as a few that have been received against it.

Mr. WILLIAMS. The committee will be glad to accept those.

(The letters referred to are to be submitted for the files of the committee.)

Mr. WILLIAMS. Permit me to congratulate you for a splendid statement.

Without attempting to prejudge the various bills that we have before this committee—and I may be basing this statment on snap judgment—it appears to me that the approach that is taken in your bill is designed to meet the very problem pointed up by the gentleman that preceded you on the witness stand. If the United States is behind in scientific development in certain fields, then I am inclined to believe, in the absence of proof that we do not have enough scientists, the crux of the problem is in channeling of the efforts of these scientists.

I am inclined to feel that the approach that you have taken in this legislation would certainly serve to meet to some extent that result.

Once again, I congratulate you on an excellent statement.

Mr. DAWSON. Thank you.

Mr. WILLIAMS. Mr. Loser?

Mr. LOSER. I very heartily concur in the statement of our chairman about your presentation. I think it was splendid, and I want to congratulate you on it.

Mr. DAWSON. Thank you.

Mr. WILLIAMS. Mr. Neal?

Mr. NEAL. I, too, think that our colleague has emphasized his viewpoint very conclusively.

I note here that this list of approving agencies or individuals is largely represented by educational institutions.

Mr. DAWSON. And we had quite a few scientists that appeared before our committee and testified, and they all agreed that part of the great problem was this lag, this lack, this failure to break through, and they felt that an establishment of a fund such as this that would be available to them without the budgetary problems that arise in coming to seek funds would be of inestimable service to this Nation in this hour.

Mr. NEAL. In testimony before your committee, did you have many representatives of industry?

Mr. DAWSON. We had many representatives of industry. We had testimony on the different efforts taken in different countries to promote basic and applied research.

You know, industry is after things that will help them along, and consequently there may not be continuity in their efforts on basic and applied research. Yet all of these improvements and some of the greatest innovations of all have come from that type of investigation.

We feel that if this country will encourage that basic and applied research and make it possible to carry it on without coming back to Congress every time an appropriation is needed, it will pay us off in large dollar-and-cent savings and certainly help us to regain the lead we have been trying to regain in the scientific world.

Mr. NEAL. Did industrial witnesses bring out any viewpoint that would lead you to believe that the interchange of scientific knowledge as it might be revealed to representatives of industry would indicate that industry largely devotes itself to the application of already discovered basic research, or that in their process of interchange of information that they derive through their own studies, that alone might contribute toward the discovery of many things that really are basic?

Mr. DAWSON. No; they did not emphasize that so much. And you can understand why. In any particular industry, their research would be in line with their industry.

Mr. NEAL. Applied.

Mr. DAWSON. Applied. But they would not be interested in basic research as such.

Mr. NEAL. Let us get back to the basis of present-day knowledge in industry and in science generally, in medicine, in chemistry. Would you say that all the new discoveries that have come into our everyday life today have resulted from applied research? Do you not think there has been a lot of basic research going on back of all that?

Mr. DAWSON. There has been some basic research in a particular industry in a matter calculated to aid that industry in its efforts to benefit itself. You can appreciate that. But in industry there is not the interest that we would like to see basically applied.

Industry is not going to spend the money.

Mr. NEAL. I do not know whether I can accept your viewpoint or not. When I realize how much progress has been made over the last half century in every branch of science and the application of those scientific discoveries to our present-day productive capacity, I just wonder, if we have accomplished those things without Federal aid up to this time, how we can expect to increase that result by letting the Federal Government get into the picture.

Mr. DAWSON. I would not say that we have discovered those things without Federal aid, because most industries are aided federally. If you take the Bell Telephone Co., if you take any of our great industries, you will find that in their research, and so forth, they have gotten Federal aid.

Mr. NEAL. To what extent? Would you give some specific example?

Mr. DAWSON. No, I cannot point to a specific example, but I can get them for you.

Mr. NEAL. It might be interesting to the committee to have those specific examples where, up to a period of 10 years prior to this date, the Federal Government made contributions toward such discoveries.

Mr. DAWSON. Up to 10 years ago, I would not say that, sir.

Mr. NEAL. Of course, the National Science Foundation has been created within the last 6 or 8 years. Many phases of Government activity have gone into industrial research since then. There is no question about that.

But the question is, how superior is our present situation now through the influence and the aid of Government support to that which existed 10 years ago, prior to the time when the Government assumed the responsibility?

Mr. DAWSON. I think so. It is almost incomparable. I think we have made greater progress within the last 10 years than in any period theretofore in research in industry.

Mr. NEAL. Would you attribute that great progress to Government stimulation, or would you attribute it, accept it as an accumulated scientific progress that has just reached a point of awakening?

Mr. DAWSON. You pose a nice question, because the thing has not grown up overnight. I think within the 10 years it has been stimulated. But I think in the meantime, in the last 10 years, of the amounts of money that have been poured into research and poured into these different agencies through this National Foundation.

But the thing that alarmed me at these hearings was that they had insufficient funds ofttimes for pursuing a given basic research that might or might not develop into one of the best weapons that we had. When I say weapons, I do not mean entirely weapons for war, but weapons of peace, also.

I think that industry has been immeasurably benefited since the establishment of the National Science Foundation. I think industry has got as much benefit from it as anything else, and I think the Nation has gotten benefit from it because it is in better shape than it otherwise would have been to meet the challenge of today.

Mr. NEAL. Let us project that into the future a little bit.

Incentive, whether it is for profit or individual satisfaction or what-not, usually is lost to a certain extent when the Federal Government assumes the obligation. If we get deeply into this thing, do you assume that industry on its own will go on and make as much progress in development and applied scientific knowledge as they have done in the past? Will they not be looking to the Government for support more and more as time goes on?

Mr. DAWSON. No, I do not think so. But certainly they are looking to the Government right in these trying times to meet the challenge, and the Government must meet that challenge. We are living in a world now of coexistence, and we must meet the challenge; whether we like the totalitarian way of life or not, it is a challenge to us.

Will free enterprise as such, as we have here in the United States, be able to meet it? In Russia, they pay the scientist a high salary. But they put him in the army, and they get the benefit of everything that he does. We have got to meet it in another way, and I am thinking that the establishment of this fund, to assure the continuity of research, basic research, will pay off in dollars and cents far beyond what we can now comprehend.

Mr. NEAL. Thank you, Mr. Dawson.

Mr. WILLIAMS. I have one question.

Have you had an opportunity to read the reports of the various agencies on your bill?

Mr. DAWSON. No, I have not.

Mr. WILLIAMS. I have a copy of the report of the Bureau of the Budget dated May 10, 1958, which is just a day or so ago, in which they take a position of opposition to the bill you have introduced, on various grounds.

Perhaps, in view of the fact that you have not had an opportunity to read these, it would be better to defer any questions on them at this time.

Mr. DAWSON. I will take the opportunity to read them, sir.

Mr. WILLIAMS. I think I will let that pass for the moment.

Mr. Bush?

Mr. BUSH. Mr. Chairman, I was tied up with some schools this morning, and did not have the opportunity to hear our colleague's entire testimony. I know of his great interest in the science field.

Mr. DAWSON. I would like to say to Mr. Bush that we miss him on the committee. I wish you had been present to listen to all this long line of witnesses, both from industry and from the scientific world, testify before the committee as to the value of such a fund in establishing the continuity of effort to bring forth results.

Mr. BUSH. I think you are to be commended for your interest in the scientific field. There is always that problem of just how far we would go with a lot of these projects and still keep our free enterprise system alive in America. We could very well be pyramiding these various programs and awaken some morning to find they have gotten entirely out of hand.

Mr. DAWSON. It is of interest to me to see the long-haired boys, as we used to call them, the scientists, that we used not to pay any attention to, now carrying the burden.

Mr. BUSH. Do you not think that the scientists are doing a very great work today, more than they have ever done?

Mr. DAWSON. Yes, sir, and many of the things they are doing have been handicapped and stopped. There have been various delays and lags in our own program. Some of the work that they had begun and started well had to be neglected. I think it is worth while to keep those projects going. I think we will gain from it far more than we will put into it.

Mr. BUSH. Could you name some of those projects?

Mr. DAWSON. Of applied science and research? I cannot name them to you, but I can get the testimony that was given at the time and make that available to you.

Mr. BUSH. I think that would be desirable.

Thank you.

Mr. WILLIAMS. Mr. Loser?

Mr. LOSER. I have nothing further.

Mr. WILLIAMS. Are there any further questions?

Thank you very much.

Mr. DAWSON. Thank you.

Mr. WILLIAMS. Once again, thank you for an excellent statement.

(The following letters were later received from Mr. Dawson:)

HOUSE OF REPRESENTATIVES,
COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D. C., May 22, 1958.

Hon. JOHN BELL WILLIAMS,
Chairman, Health and Science Subcommittee, Interstate and Foreign Commerce Committee, House of Representatives, Washington, D. C.

DEAR MR. CHAIRMAN: Enclosed is a copy of a memorandum on the Navy research continuing fund prepared by the staff of the Committee on Government Operations. There is also attached thereto a Thermofax copy of statements explaining the fund, made in connection with the Navy's 1951 supplementary budget presentation and copy of a Navy memorandum of July 10, 1956, on the subject, Maintenance of Longevity Program, Fiscal Year 1957 Funds.

This information is being supplied in response to a request by your subcommittee staff for use in consideration of H. R. 10293, a bill to establish a national scientific research reserve fund.

Sincerely yours,

WILLIAM L. DAWSON, *Chairman.*

Enclosures.

NAVY RESEARCH CONTINUING FUND

The following is a presentation of the establishment of a $20 million special research and development fund in the Office of Naval Research.

The Second Supplemental Appropriation Act for the fiscal year ending June 30, 1951 (64 Stat. 1232), appropriated the sum of $32 million to be available until spent, to the Department of the Navy to support its part in the coordinated effort of the Armed Forces in basic research.

The funds were justified under two major items. First, $12 million for immediate application of the latest scientific discoveries generated by basic research to critical areas of military operations, weapons, and equipment.

Second, $20 million to stabilize the basic research program of the Department of the Navy and to insure its operations at maximum efficiency by increasing the average contract life from 1 year to an urgently required average of 2 or 3 years. The only factor affected by the appropriation of funds for the purpose of long-term financing of research projects was to be the time factor.

This $20 million is used for the purpose of assuring (1) scientific personnel employed in universities, nonprofit, and industrial laboratories, who conduct basic research projects, continuous money to arrive at a valid conclusion and (2) a term of office commensurate with requirements of the project being conducted.

The following is an example of how the Office of Naval Research employs these funds:

A basic research contract is entered with a university, nonprofit, or industrial laboratory on the basis that a project would take 2 years or more to complete. Under the existing limitation adhered to, by necessity rather than by choice, each contract must be renewed each year, with no assurance to the contractor that money would be available after the first year for its completion. In this case, current year research and development funds would be obligated for the first year cost, and this continuing fund would be obligated for the second and subsequent years costs. Upon receipt of the following year's research and development appropriation, this special fund would be deobligated and the current-year funds would be obligated for the second year's cost, thus restoring the amount for reobligation in the special fund. By this procedure the special fund remains available in whole or in part indefinitely, and through its permanent availability gives the institutions assurances that the basic research they conduct will not be cut off before the project is completed.

STATEMENT OF REAR ADMIRAL T. A. SOLLERS, USN, CHIEF OF NAVAL RESEARCH, BEFORE THE DEPARTMENT OF DEFENSE SUBCOMMITTEE OF THE HOUSE COMMITTEE ON APPROPRIATIONS, 1951 SUPPLEMENTARY BUDGET PRESENTATION

The Office of Naval Research needs approximately $32 million to support its part in the coordinated effort of the Armed Forces in the present emergency.

The funds requested include two major items. First, $12 million for an immediate and high-speed application of the latest scientific discoveries generated by the basic research program of this office to critical areas of military operations, weapons, and equipment.

Second, $20 million to stabilize the basic research program of this office and to insure its operation at maximum efficiency, by increasing the average contract life from the present average of 1 year to an urgently required average of 2 to 3 years. It should be clearly understood that the funds requested to institute the policy of long-term financing of research contracts will not increase the cost of this program to the taxpayer. Withdrawal of funds from the Treasury will not increase. The size and scope of the basic research program will not increase. The only factor affected by the appropriation of funds for the purpose of long-term financing of research projects will be the time factor. Research projects now financed for 1 year will then have an average life of approximately 3 years.

The proposed supplementary budget capitalizes at this time on the investment of the Office of Naval Research during its 4½ years of existence. The items selected for immediate exploitation are the result of the findings of the broad research program of the Office of Naval Research viewed in the light of urgent Navy requirements. In fact, it is just this selection and emphasis on carrying through that is the payoff on the investment. Now more than ever the entire research program should be maintained in order that similar items may be recognized and exploited in the future directly as they occur. This is the only way in which the country can make certain of maintaining scientific and technological superiority over a potential enemy. In any possible conflict it is absolutely essential that we pay especial attention to this type of superiority since it is one of our most important assets. Furthermore, there is every evidence that the ONR program of research has the support and the confidence of the country's scientists. It is already clear that they are ready to play their part in carrying out any supplementary program of development in critical areas important to defense.

I should like, in closing this statement, to quote briefly from the Under Secretary of the Navy's talk to the West Coast Procurement Planning Conference, as follows:

"We have less time than we thought to complete our stockpiles. I believe we should get on with this job as quickly as possible. I like to consider our stockpiles in at least three categories.

"First, in the ordinary sense, as a reserve of critical raw materials * * *

"There is a second stockpile * * * our reserve of industrial strength and productive capacity * * *

"There is a third stockpile item we must not lose sight of. I refer to the stockpile of scientific research. Even though there is added emphasis today on the necessity for practical development of the research we have already proven, there is still time to pursue further our most important basic research projects.

"We are giving attention now to the conversion of certain of our research projects into production items * * *

I should also like to make another short quotation from the report of the president of the Massachusetts Institute of Technology published October 1950. I make this second quotation for the purpose of illustrating to you the situation which exists generally in all the academic institutions having contracts with my office.

"In presenting my annual report at this time, I do so with the awareness that our programs and our planning at the institute are subject to change without notice, and that the only policy that we can be certain is sound is to keep ourselves in the state of readiness to serve our Nation, which must now mobilize its might as the surest way to prevent a war as well as to maintain the essential condition for our defense. I can report to you with confidence that all groups at the institute share in this feeling of responsibility. Underlying all of our policies and planning is a clear commitment to be guided by the national interest and not by self-interest.

"*Research policy.*—The scientific situation today is quite unlike the period prior to World War II. At that time there was no appreciable mobilization of scientific resources and the civilian scientists and engineers had scant familiarity with military problems or planning. In contrast, we now have extensive scientific mobilization already as a result of the development of large Government laboratories and the sponsored research programs of the armed services. Moreover, large numbers of our scientists and engineers are well informed about military problems, and hundreds of them are actively participating in military planning, as, for example, through the organization of the Research and Development Board.

"With these considerations in mind, I suggest that MIT should continue its basic educational and research activities as uninterruptedly as possible, especially since they bear directly on national defense. We can make our maximum contribution to national security by doing thoroughly what we already have undertaken. As you know, we are already carrying a heavy load of research and advisory activity in connection with national defense. We are prepared to continue this with vigor, or, as the need may dictate, to expedite and to expand it."

JUSTIFICATION

Research and development:	
Presently available	$31,678,000
Revised estimate	60,678,000
Difference	29,000,000

Funds currently appropriated are being used to continue the support of the programs of basic research and development administered by this Office. Such programs are considered to be the primary source of new scientific information upon which really significant improvements or changes in military weapons, equipment, and operational techniques will be based. In addition, with especial reference to the present degree of emergency, certain projects, pointed toward the application of the most recent and promising scientific discoveries to specific military uses and problems, are already being initiated and accelerated to the greatest extent possible. Such efforts are now limited by the funds available and the necessity for maintaining the basic programs that provide the initial scientific discoveries.

Proposed increases in program

(*1*) *An increase of $9 million in the research and development program of the Office of Naval Research.*—This increase is required to finance the immediate initiation of an expanded program of applied research and development for the purpose of converting the latest scientific discoveries and information into new weapons, equipment, and operational techniques for the forces in the shortest possible time. This is planned for projects in areas highly critical for national defense, such as antisubmarine warfare, security of overseas transport, critical materials, air defense, psychological warfare, and defense against biological war-

fare. This program is designed to take full advantage of scientific information and discoveries generated by past years' investments in basic research. The specific projects involved have been reviewed and approved by the Navy Research and Development Review Board and the Research and Development Board of the Office of the Secretary of Defense.

(2) *A nonrecurring item of $20 million for the purpose of increasing the contract life of basic research projects to an average of 3 years.*—The contract research program of the Office of Naval Research is conducted in universities, nonprofit, and industrial laboratories by some of the Nation's most eminent scientists. Approximately $18 million is invested annually in this program in the form of research projects in many fields of scientific endeavor. As always in research the majority of the projects require years of intensive and continuous work to arrive at valid conclusions. Normally, scientific personnel employed by research laboratories to conduct such projects are assured terms of office commensurate with the requirements of the projects to be conducted, i. e., a minimum of 3 years. Long-term financing that meets the accepted customs of the academic and scientific world and the requirements of individual projects has been determined to be the most efficient, economical, and equitable method of conducting a program of this type.

The original appropriations for the support of this program were of the normal annual appropriation type which effectively prevented the application of this practice and substantially the present program was established on this basis. Public Law 588 (5 U. S. C. 475), formally establishing the Office of Naval Research, recognized this situation and provided for a 5-year expenditure period for appropriations made to this office. Since the passage of Public Law 588, however, other factors have prevented the annual budgets from including funds to put the practice into effect. The urgency of instituting long-term research financing during the present period of accelerated military effort has been recognized by the Secretaries of the Navy and Defense and the Bureau of the Budget. The institution of long-term financing will accomplish the following principal objectives:

(*a*) It will tend to stabilize the basic research program and assure its continued functioning in the present period of employment unrest and uncertainty by assuring research personnel of at least equal employment opportunities in basic research as opposed to opportunities offered by shifting to industrial and other wartime activities less suited to their talents.

(*b*) With the inevitable demand for scientific manpower in the defense program, it is the only way by which the supply of trained research scientists can be maintained and increased.

(*c*) It will permit the maintenance of standby research centers in research fields essential to national defense, to which critical problems can be directly referred as they arise.

Long-term financing of research projects has been recommended repeatedly by such groups as the President's Scientific Research Board, the President's Air Policy Commission, the Research and Development Board, and the Naval Research Advisory Committee.

As to be expected, the experience of the Office of Naval Research in administering its program of basic research for 5 years under the necessity of limiting contracts to a life of 1 year, has amply proven the validity of long-term financing of research contracts as a policy. Under the currently existing limitations adhered to by necessity rather than by choice, each contract must be renewed each year. Some of the advantages to be gained from long-term financing of research contracts are:

(*a*) Lower overhead rates resulting from the greater security offered to the contracting laboratory.

(*b*) Lower salaries for the scientists employed as a result of complying with the accepted academic practice of tenure of office commensurate with the research job to be accomplished.

(*c*) The long-term availability of highly qualified key scientists.

(*d*) Improved availability of key scientists formerly unobtainable under short-term contract financing.

(*e*) Increased cooperation on the part of contracting institutions through their willingness to use and even expand their research facilities and staff to conduct and accelerate the research project required.

It should be clearly understood that the funds requested to institute the policy of long-term financing of research contracts will not increase the cost of this

program to the taxpayer. Withdrawal of funds from the Treasury will not increase. The size and scope of the basic research program will not increase. The only factor affected by the appropriation of funds for the purpose of long-term financing of research projects will be the time factor. Research projects now financed for 1 year will then have an average life of approximately 3 years.

ONR : 410 : av
10 July 1956.

Memorandum from : Assistant Chief for Research.
To : Research group.
Subject : Maintenance of longevity program, fiscal year 1957 funds

1. In order to assure maintenance of the longevity program, three control figures for fiscal year 1957 funds are assigned to each division of the research group. These are :

L57—*Fiscal year 1957 longevity obligation.*—At least this amount must be invested in program longevity.

Z58—*Fiscal year 1958 longevity withdrawal limit.*—Estimated total expenditures of longevity funds by contractors during fiscal year 1958 must not exceed this limit. Estimates are to be based on contract terms.

Z59—*Fiscal year 1959 longevity withdrawal limit.*—Estimated total expenditures of longevity funds by contractors during fiscal year 1959 must not exceed this limit. Estimates are to be based on contract terms.

2. Fiscal year 1957 funds in an amount at least equal to L must be used either :

(*a*) to extend for 1 or more years, at the prevailing annual rate, tasks which were extended to the end of fiscal year 1957 or later with longevity funds of any previous year, or

(*b*) provided that such action does not increase the planned total expenditures for fiscal year 1958 or fiscal year 1959 above the assigned limits Z58 and Z59, respectively, to extend for 1 or more years, at the prevailing annual rate, tasks which were extended to the end of fiscal year 1957 or later with previous years' regular funds, tasks which expire in fiscal year 1957 and are first extended for 1 year with fiscal year 1957 regular funds, or tasks which are initiated in fiscal year 1957 and are given 1 year's support with fiscal year 1957 regular funds.

3. Longevity PJ's should show "longevity" and any "regular" funds in block 18 and 20 according to the following example :

18. Source of funds	Fiscal year	Amount
ONR	1957	$5,000 R
	1957	10,000 L
Other agencies		
20. Longevity annual rate		5,000

4. Longevity obligations and longevity withdrawal limits are assigned to the divisions as follows :

Code	L57	Z58	Code	L57	Z58
410	750,000	750,000	450	500,000	500,000
419	1,700,000	1,600,000	460	1,050,000	1,050,000
420	3,700,000	3,500,000			
430	1,900,000	1,800,000	Total	10,600,000	10,100,000
440	1,000,000	900,000			

5. Each division director is responsible for maintenance of the longevity program for his division. The longevity committee is available for consultation. Each division director is requested to report to code 400 the branch assignment of L57 figures. Each division director shall notify the Finance Division (code 500) in writing, via codes 402 and 400, of any subsequent revisions in branch L57 and R57 figures within his division.

C. B. HART.

HOUSE OF REPRESENTATIVES,
COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D. C., May 19, 1958.

Hon. JOHN BELL WILLIAMS,
Chairman, Health and Science Subcommittee, Committee on Interstate and Foreign Commerce, House Office Building, Washington, D. C.

DEAR MR. CHAIRMAN: At the hearing held by the Health and Science Subcommittee on May 13, 1958, on H. R. 10293, a bill to establish a national science research reserve fund, I was given an opportunity to submit comments on the Bureau of the Budget's views on the bill.

I

In its letter of May 10, 1958, the Bureau of the Budget raises certain objections to H. R. 10293. In the first place, the Bureau questions the justification for a research reserve fund in areas other than national defense. The Bureau claims that the time factor is important only in the defense area.

I understand that this point is being considered in detail by the National Science Foundation, which supports the bill, and has also been discussed in the testimony of Dr. Alan T. Waterman, Director of the Foundation, Dr. Detlev W. Bronk, Chairman of the National Science Board, and Dr. Warren C. Johnsen, dean of the division of physical sciences, University of Chicago.

It should be noted, however, that the Budget Bureau is somewhat deceptive when it implies that for 1959 the Foundation's proposed budget of $140 million will provide a great deal of flexibility to the Foundation in supporting research. For fiscal year 1959, the Foundation requested $56 million for research grants, and $32,170,000 for the support of research facilities, but the President's budget cut those amounts to $40 million for grants and $12,400,000 for facilities.

Even if the President's request is granted, the Foundation estimates that it will be able to meet less than half of the meritorious qualified basic research proposals it will receive. Thus it is clear that the National Science Foundation very probably will not be able to meet some research needs of considerable urgency, particularly if they arise in the latter part of the fiscal year. As Dr. Waterman testified, this is exactly what occurred in the latter part of 1957 when funds were not available for monitoring the first Soviet satellite.

It should be noted, too, that the reserve fund would also be available to meet unexpected defense needs. An example of how this might work is found in the experience of Air Force research contractors in September and October 1957. As the result of an unexpected withholding of funds by the Secretary of Defense, the Air Force suddenly terminated 254 research and development contracts, many of them involving research by colleges and private firms. This action, which caused disruption of a considerable number of research activities, is presently being investigated by the staff of the Committee on Government Operations with a view to determining its full effect. It is obvious that slippages of several months occurred and perhaps some projects were irreparably damaged. Had the reserve fund been available, the National Science Board could have stepped into the breach and provided continuity for those projects which it considered essential to the national interest. Although the funds were later restored to the Air Force after the present Secretary of Defense was appointed, in many cases the damage had already been done. As of the latest report to the committee, only 79 of the 254 contracts had been successfully renegotiated.

In the case of the Army, Lt. Gen. James M. Gavin's staff reported: "Due to expenditure limitations placed upon the Army by the Secretary of Defense, no research and development contracts citing fiscal year 1958 funds were awarded in the ground mobility program during the first 6 months of the fiscal year." In addition 69 contracts were delayed by the stretchout of funds. Here again, the reserve fund would have been available to help alleviate the more serious research deficiencies.

It should be noted that in both cases, Air Force and Army, the difficulties were not caused by lack of appropriations by Congress. They were caused by the action of the Secretary of the Defense in limiting the expenditures of appropriated funds without regard to the projects to be affected. While this was a very regrettable situation, the esteemed scientists who comprise the executive committee of the National Science Board could, if they had had the fund available,

have exercised sound judgments on the projects which should have been rescued in the interests of national security.

II

The Budget Bureau's second objection questions whether the National Science Foundation should be identified with the support of applied research. H. R. 10293, it is true, permits the reserve fund to be used for applied as well as basic research. The Executive Committee of the National Science Board was selected as the administering agency for three reasons.

First, use of the Executive Committee of the National Science Board avoids the creation of a new agency to administer the fund. Further, in the National Science Foundation, the Board has an existing organization for screening and evaluating requests. Second, the National Science Foundation does, as a matter of fact, have a number of functions involving applied as well as basic research. Under section 3 of the National Science Foundation Act of 1950, the Foundation is authorized and directed at the request of the Secretary of Defense to initiate and support specific scientific research activities relating to national defense. The section also authorizes and directs the Foundation to evaluate scientific research programs undertaken by Federal agencies and to correlate them with those of the Foundation, and also to foster the interchange of scientific information. None of these functions is limited to basic research. Third, placing the fund under the Executive Committee of the National Science Board would tend to insure that basic research will not be overwhelmed by applied research in the use of the fund.

III

It is noted that the Department of Health, Education, and Welfare also expressed some objections to the bill. However, these do not seem substantial.

The Department fears the reserve fund may disturb a so-called balance in Federal research programs. This argument ignores the purpose of the fund which the bill itself and the legislative history make very clear. The existence of the fund will not affect the regularly planned and budgeted programs of Federal agencies.

The fact is that vigorous scientific progress should and does not occur along the lines of a bureaucratic concept of balanced programs. Nor should significant progress be delayed or stopped because of such a concept. The fund will allow rapid advancement to be made when important new breakthroughs occur without waiting for artificially balanced programs to catch up with scientific realities.

The Department's description of the Executive Committee of the National Science Board as a "small, part-time group" is hardly an accurate characterization. The National Science Board is by law the policymaking body of the National Science Foundation. The Executive Committee is by law the top committee of that Board. All of its members are appointed by the President with the approval of the Senate. The Committee is, then, an important and integral part of our Federal scientific organization.

IV

In closing, I would like to cite two quotations. The first is from the report entitled "Research and Education in Meteorology" issued on January 28, 1958, by the Committee on Meteorology of the National Academy of Sciences, National Research Council. In discussing three notable characteristics of meterological research as it is presently being conducted which are incompatible with satisfactory progress, the Committee states:

"The first of these is the lack of stability. This deficiency was brought home in painful fashion in the fall of 1957 when Government expenditure ceilings resulted in the termination of a substantial number of research contracts at the universities. Besides disrupting the research effort, this unfortunate situation had the more serious consequence of discouraging promising students from entering or continuing in a field in which the continuation of a program, once started, is subject to such uncertainty."

The second quotation is from a talk made by Dr. Charles J. Hitch, chief, economics division, RAND Corp. to the Conference on Research and Development and Its Impact on the Economy on May 20, 1958. Dr. Hitch stated:

"But keeping the technological jump on the enemy—even if measured in months—may be even more important than keeping the jump on competitors in an economy. It may indeed be essential to our survival in the nuclear age."

H. R. 10293 will, if enacted, provide a potent instrument for keeping "the technological jump" so vital to our survival as a free nation and as the leading force for freedom in the world.

Sincerely yours,

WILLIAM L. DAWSON, *Chairman.*

Mr. WILLIAMS. The next witness is our colleague from Florida, Hon. Robert L. F. Sikes. Mr. Sikes, we will be glad to hear you at this time.

STATEMENT OF HON. ROBERT L. F. SIKES, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF FLORIDA

Mr. SIKES. Mr. Chairman, our Nation today is faced with one of the great challenges of all times. This is the necessity for training an adequate number of scientists and engineers to provide the research and development work so important in this era of space ships and planet exploration.

The free world is looking to the United States for leadership, guidance, and hope in the struggle for existence against the menace of communism. But, unless we are prepared to forge ahead in missile development and space exploration, as well as in the peaceful development of atomic power, we cannot expect the other nations to continue to look to us for leadership. More important, we cannot maintain the confidence of our own citizens when we, long considered the most advanced peoples of the world, lose sight of the necessity for development in the fields of science and engineering.

Mr. Chairman, I have introduced H. R. 10180, a bill to amend the National Science Foundation Act of 1950 to encourage the training of additional engineers and scientists and the expansion of facilities for engineering and science education by providing scholarships and fellowships for science and engineering students. It is my firm conviction that this or some similar program must be established.

I have been very encouraged in recent months to see a more active interest in many areas in promoting science and engineering in several important phases of our national life. This added emphasis on the importance of the scientific and engineering fields, if supported by a serious effort to get more of our youths interested in the fields as provided in such measures as H. R. 10180, will within time, provide our Nation with at least a minimum number of qualified scientists, engineers, and teachers in the science and engineering fields.

Arguments are being advanced that such a program would be far too costly to administer. But, I ask, how can we expect to have a future America as we know it today, if we neglect the maintenance of qualified people to develop the mechanisms and methods to guide us in the right direction?

The Nation's leading scientists and engineers have expressed the need for such a program as I have advanced in H. R. 10180. The great industries and laboratories have spent thousands of dollars in an effort to attract qualified scientists and engineers. And, I might add, the help-wanted ads are dominated by calls for these fields.

Therefore, Mr. Chairman, I urge the members of this committee to give every consideration possible to the establishment of a program

that will provide incentive and encouragement to the youths of today who are gifted in the scientific and engineering fields, to pursue the best education possible through scholarships and fellowships. In this way, we will, within a few years, have a greatly increased number of scientists, engineers, and teachers, to insure the continued progress of our Nation and to insure that we will have the ability to lead the world in missile development, space exploration, industrial development, and atomic research for peaceful purposes.

Mr. WILLIAMS. Does that conclude your statement, Mr. Sikes?

Mr. SIKES. Yes, it does, Mr. Chairman.

Mr. WILLIAMS. Are there any questions? If not, the committee appreciates your appearance and testimony.

Mr. SIKES. Thank you, Mr. Chairman.

Mr. WILLIAMS. We have one more witness scheduled this morning, Dr. George Lee.

Will you identify yourself for the record, please, Dr. Lee?

STATEMENT OF GEORGE H. LEE, DIRECTOR OF RESEARCH, RENSSELAER POLYTECHNIC INSTITUTE

Mr. LEE. I am George H. Lee, director of research at Rensselaer Polytechnic Institute, Troy, N. Y.

Mr. Chairman, the statements made this morning raise quite a few questions in my mind, and I would like to be able to interpose at times in my statement certain comments on previous statements. May I do this?

Mr. WILLIAMS. Surely. You are not confined to your prepared paper.

Mr. LEE. That is fine.

I feel there are several problems that must be brought into the consideration of H. R. 10293 and the similar bills being discussed at these hearings. When we consider research, whether it be basic or applied, we must consider (1) the agencies that will perform the research, (2) the scientists and engineers who will perform the research today, (3) the scientists and engineers who will perform the research tomorrow, and (4) the beneficiaries in the results of such research.

Traditionally, our colleges and universities have been the principal sources of new knowledge acquired through basic research and of the expansion of existing knowledge through applied research. This new knowledge has been given to our country and to the world with little thought of gain except professional recognition for the researcher and for his college or university. In the past, the contributions of the faculties of our colleges and universities have been possible only because of the inborn desire of the researchers to explore the unknown. The privilege of performing research is as important and as necessary to our researchers as is the freedom of speech, the freedom of the press, and all the other privileges we take for granted are to every person in this country. Unless this freedom in research is available, there are many scholars who would not devote their life to academia.

With the detonation of the explosive technological growth of our country during and following the Second World War, colleges and universities were hard pressed to meet the increasing educational de-

mands placed on them and also to meet the rapidly growing need for academic research. The inflationary trend made it increasingly difficult for academic institutions to finance both the education of our children and the research of their faculties. Quite naturally, with external support available for applied research and engineering development, faculty researchers moved from the research of a more basic nature toward the research for which they could get support. This was not entirely to their liking but better applied research and engineering development than no research at all.

Our country was and is rapidly depleting our national reserve fund of available knowledge with little concern, seemingly, of maintaining an adequate rate of acquiring new knowledge to replenish this fund. Colleges and universities have long been aware of this very critical situation. The situation is not only serious from the viewpoint of our national security, but it is also serious from the viewpoint of our future economy. We have all followed with interest the international satellite race. The results have been spectacular and politically important, but extremely discouraging to those of us interested in research. Mr. G. A. W. Boehm summarizes the present undesirable position of research in our national defense effort, the position resulting in part from the satellite race, in his article, The Pentagon and the Research Crisis, page 134, Fortune, February 1958. I strongly recommend this article to those people interested in our country's welfare and security.

There is a second article in Fortune that appeared in May, by Dr. Klein of the Rand Corp. It is written after a 5-year analysis of Government research and development. The article is staggering, and I think it should be read by at least every Congressman with thoughts of doing something about it.

It was mentioned a while back, Are We Behind Russia in Government Research or in All Research? I think this article of Dr. Klein's will point out possibly why a government or a United States satellite was later than a Russian satellite. I think it is very carefully written, a very sincere study of our situation.

Many of the new weapons of today were actually born years ago, sired in many instances by scientists now long dead. Where we are spending billions of dollars exploiting our present knowledge, we are spending dollars replenishing the fund of knowledge we are now rapidly depleting. I predict that the wars of the future, in all probability, will be won using weapons not yet conceived and based on knowledge not now available. Too much emphasis is placed on the spectacular and too little emphasis is placed on the important. This statement, with a few changes in wording, could also be applied to our economic future.

Our experience in technology has demonstrated that engineering development activities can be put on a "crash" program basis. On the other hand, basic research cannot be so programed. The little experience we have had definitely justifies this statement. New knowledge, the result of basic research, comes only with time and with the individual. Doubling the number of researchers on a basic research program in all probability will not increase the rate of obtaining new knowledge. New knowledge cannot be programed. Who could have told Albert Einstein to formulate the theory of relativity on a

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specific day? The theory of relativity, however, has been one of the major stepping stones to our present nuclear age.

The bills that are tending to encourage high-school children to enter into the sciences: Scientists are rather unusual people; that is, the top scientists are. We have at Rensselaer, which is extremely fortunate considering the size of the school, 5 or 6 really outstanding scientists of international reputation. One man, a physcial chemist, a German, has done more or as much for the peaceful use of the atom in this country as any other man. He is Paul Harteck, who was president of the University of Hamburg during the war. He was the one that suggested to the Third Reich the possibility of a nuclear reactor and the possibility of an atom bomb in 1938, the first on record to have been proposed.

Fortunately for us, the Third Reich was not interested.

He is now in this country, has been working on radiation chemistry, has developed not only means of transferring from nuclear energy to chemical energy, but has gone so far as to develop a method, a process—all from his basic research, developing into applied research—for fixing nitrogen by the use of nuclear radiation. Of course, fixed nitrogen, nitrous oxide, forms the basis of a fertilizer, and is one of the most important commercial chemicals we have.

In the process of his radiation chemistry research he went to the AEC and asked for glass wool containing uranium. The idea was to get uranium finely dispersed throughout a volume. At that time, he was still an alien—he is now a citizen—and did not have the proper clearance. When the AEC said they did not have glass wool containing uranium, he thought they were trying to hide it from him. They finally convinced him that they actually did not have it. So he asked permission to go to the Owens-Illinois Glass Co. to talk to them about it. He got permission and went ahead. They were enthused. They spent a great deal of money on their own in developing a formula for spinning glass wool containing uranium.

This proved to be very successful in the fixing of nitrogen. That was started about 2 years ago. We are now in the process of actually finding out the engineering information necessary to say it is a feasible process. It looks very promising. We have attempted to put Owens-Illinois under subcontract with us, based on our prime contract with the AEC. They are still working, not getting paid for it yet. They have produced some amazing fine fibers containing up to 30 percent uranium by weight, which is just about what we want, but we cannot get a subcontract through because of one thing: The contract is only a $50,000 contract; but the Government insists that the Owens-Illinois Glass Co. change their complete depreciation system because of this one $50,000 contract, and we cannot get a contract signed.

This is stymying Dr. Harteck's work. Now, are we making progress when the Government will stymie a scientist's work just by a little thing that would not amount to more than a few dollars to the Government? It is very aggravating.

Mr. BUSH. Mr. Chairman, perhaps they did not ask for enough, $50,000.

Mr. LEE. Well, the thing is, we have already spent close to $100,000 on our own without charge to the Government, and now this one little thing, we cannot get money for.

But I get started on these side issues, and I do not know when to stop.

H. R. 10293 proposes to establish a research reserve fund. This is a very important and necessary step forward. Much of the research to be supported by this fund will, undoubtedly, be performed in the laboratories and offices of our colleges and universities. These research programs, in the majority of instances, will be proposed by the academic researchers. How will these researchers develop the ideas on which to base their research proposals? Who will pay for the preliminary work to develop the ideas to the level at which the resulting proposals can be evaluated? These questions could be easily answered if our educational institutions could be placed in the same advantageous position as industry.

But bear in mind, colleges and universities are designated as nonprofit organizations and so are placed in a very definite category. The costs involved in the preparation of proposals are important. Please bear this in mind. I have somewhat to say about this before I present two suggestions to be considered for incorporation in H. R. 10293.

In the following I am concerned primarily with the privately endowed educational institutions. The income of these colleges and universities comes from several sources: (1) Tuition payments, (2) income from endowments, (3) current gifts, grants, and bequests, (4) auxiliary enterprises, and (5) research. As we know, the cost of education has risen rapidly during the past 10 years. The rise has been much more rapid than it has been possible to raise tuition. As of the present time, the cost of education at Rensselaer Polytechnic Institute is approximately $1,800 per student per year. The tuition rate is $1,200 per year. There is, then, a difference of approximately $600 per student per year that must be made up from sources of income other than tuition.

Income from endowment is approximately $240 per student per year at Rensselaer. This leaves a deficit of approximately $360 per student per year that must be made up in some way, usually through gifts and grants.

I use Rensselaer only as an example. I could have used almost any other privately endowed college or university in the country and the example would have been essentially the same. To maintain a competent faculty, it is necessary to enable the faculty members to be active in research in the areas of their interests. Let us examine this in a little detail.

Financial support for research, ranging from partial to complete support, is available to academic researchers from various agencies: the Government, foundations, industry, and the educational institution with which the researcher is associated. The major portion of the support for research is obtained from the Government. This governmental research may be obtained under contracts carrying the designation of cost-reimbursement or may be in the form of grants or contracts of the cost-sharing type. Industrial support, which is a minor portion of the total research support in educational institutions, is in all instances sufficient to cover completely all costs involved in research. Since this hearing is concerned with Government supported research, I will limit my discussion to that.

The indirect costs in research are as real as are the direct costs. This can be verified by any accountant. The Government will not assess the allowable overhead until after the fiscal year for which the overhead is to apply. The overhead is then assessed according to an entirely arbitrary set of rules contained in the Blue Book and condensed in the Armed Services Procurement Regulations, section VI, part 3. I would like to give 1 or 2 examples from these rules.

Recall that indirect costs, overhead, are considered as being those costs not readily assignable as direct charges to a specific contract. In part, these charges are composed of apportioned usage and depreciation charges. Library facilities, as we all know, are as essential to research as is research equipment. The Government arbitrarily sets the life of a reference book at 50 years with an average value of $2. Research equipment, according to the Government, is supposed to have a life expectancy of 15 years. Who can, at the present market, buy a reference book for $2—they actually cost $12 or $15—and what reference book will be of any value for more than 5 years? What part of a research laboratory's equipment is worth the space it occupies after 5 to 8 years?

I use these two examples, and there are many more, to indicate that the Government is not paying the entire cost of its contract research. The normal contribution of colleges and universities to Government research, under cost-reimbursement type contracts, is composed of a large share of the indirect costs. The overhead at Rensselaer for its overall operations averages at about 95 percent of personnel charges. We are proposing an overhead rate of 70 percent for Government research for fiscal year 1957. We arrived at this rate through our interpretation of the Blue Book.

This is still in negotiation, and it is almost the next fiscal year, and no end yet in sight.

We feel we are completely justified in our claim. The difference between our overhead and the overhead allowed by the Government is, then, our contribution to Government research. Our overhead for fiscal year 1956 was 56 percent. (That means that we are contributing approximately 40 percent of our personnel charges to all Government research.) This contribution is increased by many disallowed charges and an occasional overrun in budgetary allotment.

The cost-sharing type of support for Government research requires that the educational institution must contribute up to perhaps one-third of the total costs of the research. Referring to my cost analysis above, all contributions we make to Government research must come from our educational fund. Why should the Government expect privately endowed colleges to make this contribution to its research? I would suggest that Congress would do well to look into this question.

The discussions are now about the education of young engineers and scientists. The colleges contribute not only to the education of the young engineers and scientists, but are always contributing to Government research. I think there is something definitely should be looked into here.

Why, then, do academic institutions accept Government research, when this research only increases their financial difficulties? If we are to produce graduate and postgraduate scientists and engineers of quality, these graduates and postgraduates must have been exposed

to a scholarly atmosphere and must have been able to participate in research of a scholarly level. We could eliminate all of our financial difficulties, and incidentally not fulfill our obligations to the country, if we would follow 1 of 2 rather undesirable paths. We could drop our research activities, drastically reduce the scholarly level of our faculties, and produce very mediocre graduates and no postgraduates. This would reduce the cost of education sufficiently to enable colleges and universities to stay within their tuition and endowment incomes. How disastrous this would be for the country. On the other hand, we could reduce the number of students to one-third or one-fourth of the present number. This would lower the total cost of education and would triple or quadruple the endowment income per student. This would place educational institutions in a very favorable financial position. We could then carry on a limited amount of research at our own expense. Again, this path would would be disastrous to our country. Privately endowed colleges will not follow either of these two paths unless they are literally forced to do so.

I wish to make the following suggestion for incorporation in H. R. 10293. The support from this fund for research in academic institutions is to be sufficient to cover the entire costs, both direct and indirect, of such research, the indirect costs to be assessed according to the accounting practices of the educational institution and on the basis of a no-profit, no-loss operation.

Educational institutions do not wish to make money on Government research. We do feel, however, and feel quite strongly that the Government should carry its load in paying for the research, which means that research done for the Government should be a total cost with no-profit type of contract.

Mr. NEAL. May I ask the gentleman a question at this point?

Mr. WILLIAMS. Dr. Neal.

Mr. NEAL. It would be extremely interesting to the members of the committee if you would submit at this point in your presentation the type and variety, the identity of research projects that you are carrying on at Rensselaer for the Government.

Mr. LEE. I would say we have in the neighborhood of around 70 to 80 programs with the Government.

Mr. NEAL. For the Government?

Mr. LEE. For the Government.

Mr. NEAL. Would you be kind enough to place those in the record?

Mr. LEE. Yes. I cannot tell you the numbers of the contracts, but I can tell you practically all the agencies.

Mr. NEAL. I think that information will be quite effective, and would help to give the committee an opportunity to know something more about where Government funds are going. We would be very happy to have that list inserted into the record.

Mr. LEE. Actually, if you wish, I could send you a detailed list of our projects.

Mr. WILLIAMS. I think that is what Dr. Neal is interested in.

Mr. LEE. I could do that very easily.

Mr. WILLIAMS. If you would send that to the committee, it would be included as part of your remarks in the record at this point.

Mr. LEE. Fine.

Mr. BUSH. And along with that, Mr. Chairman, if he could, if it is available, furnish what financial contribution each agency is making to your school.

Mr. LEE. Yes.

Mr. BUSH. Would you send that along?

Mr. LEE. Yes.

Mr. WILLIAMS. May I interrupt you further?

I think what Dr. Neal is interested in, and certainly I would be interested in, is the type of research being conducted in each of these programs.

Mr. LEE. I can give you that. In fact, I can do this: I have copies of our annual report on research in my briefcase, and I shall be glad to give you copies of those, and I will make up an up-to-date list. This is for fiscal 1957, that my own report covers. I will make an up-to-date list of our sponsoring agencies.

Mr. WILLIAMS. That will be fine.

Mr. LEE. Research activity, closely integrated with the instructional activity, is essential to the effective education of scientists and engineers. This is research that is performed by the professors and their students on the campus of their college and the research that produces contributions to our fund of knowledge. I wish to make the following suggestion.

To encourage and support basic research effectively, there should be incorporated in H. R. 10293 the provision that the Government will contribute to each college and university in the support of academic research and the development of research ideas, the contribution to each educational institution to be set at 10 percent of the total Government support for integrated contract and grant research at that institution, this money, in the form of a grant, to be administered by the educational institution and subject to audit by the Government. Academic and integrated research is here defined by the statement contained in the first two sentences of this paragraph.

I want to point out that all educational institutions operate either on a cost-reimbursement type of contract with the Government or on a cost-sharing type of contract basis, or on a grant. This means that the cost-reimbursement type, as I have said before, pays the total direct costs plus those indirect costs assessed by the Blue Book or ASPR. The grants and the cost-sharing contracts require that the educational institution contribute up to a third, sometimes even more, of the total cost of research. There is no fee charge at all by educational institutions on contract research for the Government.

This statement I have here would essentially be a fee, but a fee to promote basic research as the development of research ideas.

Now, our faculty members who are topnotch researchers are just dripping ideas. Someone has to pay to get the idea started. Rensselaer Polytechnic Institute, which is not a wealthy school, in salaries alone last year—I do not know what it will be this year—paid out approximately $150,000 to help develop research ideas.

That is a lot of money for a school of RPI's financial size to contribute. This does not include, of course, the cost of equipment, supplies, materials, and that sort of thing. This is just the direct salaries.

Mr. NEAL. Pardon one more interruption.

Does the agency of Government which requests a certain research project of your institution set the price voluntarily, require a certain amount of matching funds?

Mr. LEE. No. For instance, National Science Foundation, I think, is one of the best things that ever happened to this country, by the way. They give a grant with a fee or a contribution to indirect charges of 15 percent of the total grant. This does not nearly cover our indirect charges, but there is no auditing of our books. We have to make a financial statement to them, but there are no auditors coming in all the time and allowing and disallowing charges, and so on.

The cost of operating the National Science Foundation work is much less as far as indirect charges are concerned than our contract research. So we have no complaint about the National Science Foundation and its small allotment of indirect charges. We would like to have it more, of course, to pay the total amount, but as it stands it cannot, I guess.

Mr. NEAL. Does the same rule prevail with the Army and the Navy and the other military establishments?

Mr. LEE. Yes. What has happened, to review a little bit of the history of this, is that the Blue Book, as it is called—because it is covered in blue—is a little sheaf of mimeographed notes that are made up, I think, first by the Office of Naval Research back in about 1947 or 1948, very early in the organization of the Office of Navy Research, to cover the indirect charges or to assess the indirect charges for educational institutions.

Bear in mind that the era of contract research for educational instiutions is relatively new, only about 10 or 12 years old. In the early days, the contract research was usually small in the educational institution.

That meant that the administrative duties involved in research were passed into the various deans' offices or the comptroller's office. It is very difficult to separate out the indirect charges. So, as a stopgap measure and one that worked out fairly well, this Blue Book was established.

Ie has been used until up to 1954, I think it was, when Armed Services Procurement Regulations incorporated section XV, part 3, which is the statement of how overhead to educational institutions should be assessed.

This ASPR XV, part 3, is just about a condensation of the Blue Book. It is a little bit broader than the Blue Book, but we have had the difficulty that our auditors still use the Blue Book, and it is very difficult to get them to see our interpretation of ASPR, because they are still holding to the Blue Book.

Fortunately, the Bureau of the Budget has now taken it upon itself to review the situation. Back in the early days of sponsored research at Rensselaer, they had a faculty committee that evaluated the proposals and did the usual minor administrative duties. This was when we had a very few contracts. There was no really serious trouble. But now, with our activities growing, we have had to establish a division of research administration, which is a separate division from the normal educational administration.

Our auditing agency will not take this into account. They mix the costs of our division right in with education and research costs, and that means that our instructional money is paying four-fifths of my budget, and my budget is devoted entirely to administration of research. It has nothing to do with education directly, but still the educational dollar pays for four-fifths of my budget.

This is what I am trying to make the auditing agency see.

ASPR permits a broadness here. Blue Book does not. They are sticking to Blue Book.

So this 10 percent I have stated here takes the place, essentially, of a fixed fee. It would be devoted to basic research and a development of research ideas. This would relieve the educational budget of this cost, and it would help us to increase our basic research activities.

I do not mean by this statement that the large nonintegrated activities should be included. I say here the integrated, the academic integrated activities, which is the research on the campus done by the professor and his students. That is the type of research I am talking about here.

In this morning's talk, there has been much said concerning fellowships for graduate study. Fellowships are very desirable for our graduate students, but I would like to point out a few facts.

A research grant or contract supports graduate students in a manner very similar to a fellowship. A very important difference between research grants or contracts and fellowships is that a research grant or contract assures the close association between the student and his professor in research.

Bear in mind that research is a major portion of the requirements for the doctor of philosophy degree. Through research grants and contracts, two academic functions are possible—the education of our graduate students, our future researchers and teachers, and the development of extended academic research programs. Through fellowship grants, we gain only one of these academic functions—the education of our graduate students. The granting of an increased number of fellowships will not materially increase the flow of students into our graduate schools. It would only shift the support of the graduate students from research and teaching to the fellowship grants.

If we start out in very early childhood, a boy or girl enters grade school and high school, and it seems to me that one of the governing conditions of a public-school or high-school education is that the student does not do home work. We are talking about how we can encourage the students to go into mathematics. We have to encourage the students first, before we can encourage students to go into mathematics, to study. And this starts in the home; it does not start with the teachers or with the students.

This last year my son graduated from high school, and he almost became a mental loafer. I know parents who complain bitterly because their children might have had an hour or so of work to do in the evening.

We talk about the Russians; we talk about the Europeans. Well, when this joke came out, of course you all heard it: When Explorer I crossed the path of Sputnik II, they said, "We can speak German now."

This is no joke. This is serious. This is darned serious.

You go up to most schools. We have developed here domestically quite a few topnotch scientists; there is no question about it. But you can count off the ones that are really major contributors to our present scientific development, and a terrific percentage of them are imports. I can name five at RPI: Harteck I just mentioned; Lenel, Swiss; Foa, Italian; Sadowsky, Russian; Jans, English; Nissan,

Iraqi. Those are our top men. They have some spark; I do not know what it is.

We have other men up there. You put the groups together, and in I. Q. tests I think they would come out about the same, our domestic people. But the imports have some spark, an inventive genius or an imagination that we do not seem to get as much in our students as they do in Europe.

Mr. WILLIAMS. I think you have just made a very profound observation.

Mr. LEE. When I was a graduate student at Cornell, the first year than Hans Bethe, of whom we have all heard, was in this country, I had a course under him, and I got to know him quite well. I asked him what the difference was between German students, undergraduate and graduate, and our students, undergraduate and graduate. He said the German undergraduates are much more mature than American undergraduates. He said the graduate students mentally are at about the same level, but the American graduate students are too well fed. In other words, they have their cars, they have all the money they need.

Of course, it was not much in those days. We were living on about a thousand dollars a year, my wife and I, but even so, we had enough to go to the movies once in a while. We had a car we could take out when we could afford to buy the gasoline. In Germany they do not do that. They go to their laboratories and they work.

I am not saying we want to make grinds out of our children. But I do say that work never hurt anybody. They have to learn how sometime to work. And they definitely do not in our public schools.

If these bills that are being considered, Mr. Van Zandt's bill, and so on, would or could if possible aim at the families, I think it would do a darn sight more good than aiming at the kids.

Mr. WILLIAMS. I believe Dr. Neal had a question.

Mr. LEE. I am sorry. I interrupted you.

Mr. NEAL. That is all right.

I think you brought out a most important point here. I think that is very easily demonstrated in our public schools today, that the first and second generation of foreign Americans almost always excel in greater proportion than the average American student. As you say, somewhere back in the line they have evidently inherited the idea that there is no excellence without great labor, and they do not hesitate to put out whatever effort is required to achieve their objective.

Mr. LEE. There is one interesting thing there. I have been in academic work practically all my professional career. I have taught I do not know how many thousands of students. But it is always amazing to me that my better students—I can look back and count them off—have been Jewish people. Why is this? Because their religion almost insists on education. From early childhood they have had it drilled into them that they must attain a profession. This, I think, is terrific.

Why cannot Christianity do this, too? There is something that we are lacking. I do not know what it is. We have had a lot of natural wealth in this country. We have been devoting ourselves to exploiting this natural wealth. We seem to think that the bigger the better, and everything like that. Anything spectacular is what we are after.

But I am very much concerned about the so-called unspectacular egghead stuff, the basic research, and I am not alone in this concern.

In the final analysis, who does benefit from the research performed at educational institutions? The researchers and the educational institutions do benefit by increased professional prestige, but they definitely do not benefit by financial return. As tangible results of academic research, we are producing our future researchers and teachers. We are producing new ideas, new concepts that will materially affect our future national economy and security. In addition to these two important products, colleges and universities are carrying out applied research and engineering development programs vital to our immediate national security. The benefits are, then, to the country as a whole, not to a single individual and not to a single academic institution.

The intent of H. R. 10293 is laudable, but there are a few statements that need clarification. These statements are:

> First. That the committee shall find that the initiation or continuation of each project for which expenditure from this fund is approved is of sufficient importance and urgency, in its opinion, to justify an immediate expenditure without carrying out the usual budgetary and appropriation procedures.
>
> Second. In the event any moneys are received by the United States as a result of projects financed by the fund such moneys shall be paid into the fund in such proportion as the share of the project financed by the fund bears to the total amount financed by the United States.
>
> Third. Said fund shall be expended for basic and applied scientific research * * *.

Statements 1 and 2 are in possible contradiction with statement 3. By the definitions on lines 3, 5, and 7, of page 2, applied research would fit into statements 1 and 2; basic and scientific research, as defined, would not. Applied scientific research is not defined.

The interpretation of the first statement cited above, to me, would be that the research to be supported by the fund is either applied research, as defined, or engineering development. Is the importance or the urgency of the research to be determined on the basis of present knowledge? Is it based on the knowledge of what the result will be?

The second statement cited above indicates that the Government anticipates a possible financial return on its investment in research. This again points up that the work to be supported may be in the nature of applied research or engineering development, not basic research or scientific research.

The statement of H. R. 10293 does not contain any indication of the nature of the support. Is this support to be of the cost-sharing type or is it to be of the cost-reimbursemnet type? If the research is performed in industrial laboratories, the support will, obviously, be of the cost plus a fixed-fee type. What type of support may the colleges and universitities expect? Will the first of my two suggestions be incorporated in H. R. 10293?

I wish to express my appreciation to this commitee for the privilege of being permitted to appear at these hearings to present my statement. I hope this statement will be of some value to you in your consideration of H. R. 10293 and the related bills on your agenda.

Mr. WILLIAMS. Thank you very much for an excellent and most interesting presentation. I regret that it will not be possible for the committee to stay in session longer in order to question you further, but the bells have been ringing for a call of the House, and it is necessary for the committee to adjourn at this time. But I do want to take this opportunity to congratulate you on what I consider to be a splendid presentation. You have certainly given us a great deal of food for thought.

The committee will stand adjourned until 10 o'clock tomorrow morning.

(Thereupon, at 12:20 p. m., the subcommittee adjourned for the day, to reconvene at 10 a. m. Wednesday, May 14, 1958.)

NATIONAL SCIENCE FOUNDATION

WEDNESDAY, MAY 14, 1958

HOUSE OF REPRESENTATIVES,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
SUBCOMMITTEE ON HEALTH AND SCIENCE,
Washington, D. C.

The subcommittee met at 10 a. m., pursuant to recess, in room 1334, New House Office Building, Hon. John Bell Williams (chairman of the subcommittee) presiding.

Mr. WILLIAMS. The Subcommittee on Health and Science continues its hearings on various bills dealing with the National Science Foundation, certain bills granting scholarships to students, and other bills to provide for a Federal program by financial assistance to science students, and a bill by Congressman Dawson to set up a reserve fund for research in the National Science Foundation, and other bills.

On yesterday when the committee was compelled to adjourn because of a call to the House, we had to interrupt the testimony of Dr. George H. Lee, director of research for Rensselaer Polytechnic Institute of New York.

Dr. Lee, we would be very happy to have you proceed with your testimony this morning.

STATEMENT OF GEORGE H. LEE, DIRECTOR OF RESEARCH, RENSSELAER POLYTECHNIC INSTITUTE, TROY, N. Y.—Resumed

Mr. LEE. Shall I continue to read the statement I had yesterday?

Mr. WILLIAMS. Yes. I believe you had reached page 7 of your prepared testimony.

Mr. LEE. Much has been said concerning fellowships for graduate study. Fellowships are very desirable for our graduate students but I would like to point out a few facts. A research grant or contract supports graduate students in a manner very similar to a fellowship. A very important difference between research grants or contracts and fellowships is that a research grant or contract assures the close association between the student and his professor in research. Bear in mind that research is a major portion of the requirements for the doctor of philosophy degree. Through research grants and contracts, two academic functions are possible: the education of our graduate students, our future researchers and teachers, and the development of extended academic research programs. Through fellowship grants, we gain only one of these academic functions: the education of our graduate students.

The granting of an increased number of fellowships will not materially increase the flow of students into our graduate schools; it

would only shift the support of the graduate students from research and teaching to the fellowship grants.

In the final analysis, who does benefit from the research performed at educational institutions? The researchers and the educational institutions do benefit by increased professional prestige but they definitely do not benefit by financial return.

As tangible results of academic research, we are producing our future researchers and teachers; we are producing new ideas, new concepts that will materially affect our future national economy and security. In addition to these two important products, colleges and universities are carrying out applied research and engineering development programs vital to our immediate national security. The benefits are, then, to the country as a whole, not to a single individual and not to a single academic institution. In this instance I wish to interpose, if I may. There has been discussion recently of a great shortage in engineers and scientists. This is definitely true when we think of the shortage of a certain type, and that is a qualified researcher.

I don't mean the trained individual, I mean the educated scientist or engineer. We have been prone in this country to think that we can, by mere magnitude of operation, overcome certain deficiencies. This I want to emphasize here: the advancements or breakthroughs are made by individuals and not by large mass production operations.

In my previous comment I made a plea for grants in contracts for research in preference to fellowships. I do this because these give a very close association between a mature researcher and his graduate students, an association that is not possible with fellowships.

It is through this close association that we are able to allow our future scientists to develop and become outstanding researchers.

I think it is very important that we do not sacrifice on research grants to enable us to have more fellowships. I think we should sacrifice on our fellowships and have more grants so we do have this assurance of a close association so necessary in the development of research scientists and engineers.

The intent of H. R. 10293 is laudable but there are a few statements that need clarification. These statements are:

> First. That the committee shall find that the initiation or continuation of each project for which expenditure from this fund is approved is of sufficient importance and urgency, in its opinion, to justify an immediate expenditure without carrying out the usual budgetary and appropriation procedures.
>
> Second. In the event any moneys are received by the United States as a result of projects financed by the fund such moneys shall be paid into the fund in such proportion as the share of the project financed by the fund bears to the total amount financed by the United States.
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Statements 1 and 2 are in possible contradiction with statement 3. By the definitions on lines 3, 5, and 7 of page 2, applied research would fit into statements 1 and 2; basic and scientific research, as defined, would not. Applied scientific research is not defined.

The interpretation of the first statement cited above, to me, would be that the research to be supported by the fund is either applied research, as defined, or engineering development. Is the importance or the urgency of the research to be determined on the basis of present knowledge? Is it based on the knowledge of what the results will be?

Why I am raising these questions is, if we are to promote basic research or fundamental research, this is exploratory research. We have not planned out what our results will be before we start. We don't know.

I want to emphasize that we are in dire need of basic research and not necessarily applied research. Our greatest shortage right now is basic research. And if we fulfill our needs, we cannot fulfill them by deciding on the urgency or the importance of a given research program. This is impossible.

The second statement cited above indicates that the Government anticipates a possible financial return on its investment in research. This again points up that the work to be supported may be in the nature of applied research or engineering development, not basic research or scientific research.

If we enter into basic research with a viewpoint of financial return, or even the thought of financial return, we are not entering into basic research. There are times, of course, when basic research has been very lucrative, but these are extremely rare. New knowledge, in itself, cannot bring money. The applications of new knowledge do.

The statement of H. R. 10293 does not contain any indication of the nature of the support. Is this support to be of the cost-sharing type or is it to be of the cost reimbursement type? If the research is performed in industrial laboratories, the support will, obviously, be of the cost-plus-a-fixed-fee type. What type of support may the colleges and universities expect? Will the first of my two suggestions be incorporated in H. R. 10293?

I wish to express my appreciation to this committee for the privilege of being permitted to appear at these hearings to present my statement. I hope this statement will be of some value to you in your consideration of H. R. 10293 and the related bills on your agenda.

In closing, yesterday I started to discuss the possibility of buying scientists and engineers. The bill that proposes to offer a reward for passing a mathematics examination concerned me very much. I think that one very definite shortcoming with the proposed bills is this: that we are emphasizing the mathematics, sciences, the physical life sciences. We have not in any way considered the social sciences.

I am not a social scientist, but I do feel that we must know something about when a person's interests or a child's interests start to firm. If we can find out when, if we can determine when a child's interests have become sufficiently firm to set his course for life—if this ever happens we don't know—if we could determine this I think it would be a terrific advancement in our educational processes.

For instance, if we can find out if a child in early high school, or high school at all, has a leaning toward the physical sciences—perhaps not a specific physical science, but physical sciences, if we can indicate to him that he has this leaning or interest then I think we can encourage him along the lines desired.

I think it is just a random choice. Just because a man has good grades in a course doesn't necessarily mean that he has interest in the course. There is one outstanding example of this that I like to cite. I can't mention names, but I would like to cite it.

There was a man who got his Ph. D. in chemistry. He had a terrific record. His academic record couldn't be beaten, I don't believe. He went with a large chemical concern in research. He didn't pro-

mote himself, he didn't advance himself, he did what he was told to do, he didn't have any imagination in this line.

The company got extremely worried. He took a series of tests, interests tests, and amazingly enough it was found that regardless of what subject he would have taken his Ph. D. in he would have still made just the same record. His real interests were in writing. He didn't know this. But now he is the editor of one of the biggest chemical journals in the country, and very successful.

Here is a man, with wide abilities, but he was not sure of his own interests. He didn't know his own interests.

If we could start in earlier to determine a man's interests, and encourage him along the lines of his interests, I think we would be much further ahead.

And I think that there should be some thought on the social sciences of research that would lead to such knowledge.

I want to thank you, Mr. Chairman, for being able to appear here.

Mr. WILLIAMS. Thank you very much, Doctor. I think that the attention that you have received from this committee during your testimony, and the questions that have been asked, is indicative of the excellence of your statement, and the interest of the committee in the matters that you have proposed to us.

Do I understand, summing up your testimony in a nutshell, that you would favor the approach to the problem that had been suggested by Congressman Dawson, with the modification that you mentioned in your statement?

Mr. LEE. Yes.

Mr. WILLIAMS. You would prefer that to the direct scholarship approach that has been presented by Congressmen Price and Van Zandt, whom you heard yesterday?

Mr. LEE. Yes.

Mr. WILLIAMS. Mr. Bush?

Mr. BUSH. I want to commend Dr. Lee for the fine contribution he made which he presented so ably. I feel it will be very helpful to the committee.

Mr. LEE. Thank you.

Mr. WILLIAMS. Mr. Dingell?

Mr. DINGELL. Doctor, I was intrigued by one aspect of your statement. I wonder if you would care to elaborate on this particular point. As I understand it, what you told us this morning was this: that our gravest need is in the field of basic research, and that there are certain specific ways that you would prefer to see that basic research done, principally through contract grants rather than through fellowships, since generally this is the most rewarding form of research in terms of actual output in the field of basic research; is that correct?

Mr. LEE. That is right.

Mr. DINGELL. You would prefer to see this form of congressional action rather than to see us engage in a broadcast form of fellowships in the engineering and generally applied forms of endeavor; is that correct?

Mr. LEE. Yes. I would like to state in this respect that normally a graduate student such as at Rensselaer, is engaged or gains his livelihood in one of several ways: he is either a teaching assistant or re-

search assistant or a fellowship man. We have very few paying their own way through.

I want to point out that a man's experience as a teaching assistant and as a research assistant is a very valuable part of his educational program.

Mr. DINGELL. Would you say it is more valuable than a fellowship?

Mr. LEE. In a fellowship he is on his own, in a sense. He is with his professor, of course, but as a teaching assistant or research assistant he is in very close association with the professors, very close. He works with them.

Mr. DINGELL. Do both of these people, men acting as research assistants and men acting under a fellowship, do they both engage in basic research?

Mr. LEE. Yes. Normally, though, the man under the grant or contract is engaged in a research program of burning interest to his professor.

Mr. DINGELL. What does the man on the fellowship do?

Mr. LEE. He proceeds on a research program both to his liking and to the—primarily to his liking. In general, the professors try to spend as much time with their graduate students as possible, of course. A man on a research program is with the professor during his work on the program, which may be 5, 6, or 7 hours a day or maybe more, where a man on the fellowship may see his professor say once a week on his research.

Mr. DINGELL. How much of the grant man's time is spent with the professor on teaching or on problems not related to research?

Mr. LEE. Not related to research?

Mr. DINGELL. Not related to research. In other words, how much of his time would be valuable from the research standpoint and how much would be more or less wasted or at a low level of efficiency on the research angle?

Mr. LEE. I would say that from 24 hours a week up would be spent with the professor.

Mr. DINGELL. On research?

Mr. LEE. On research. The rest of his time would be devoted to his studies.

Mr. DINGELL. Would you care to tell us which of these bills comes closest to the suggestions that you have offered us this morning?

Mr. LEE. I feel Mr. Dawson's does, in this respect: Here is a fund of money set up for emergency use in research.

Mr. DINGELL. Would you have suggestions as to the amendment of Mr. Dawson's bill?

Mr. LEE. Yes, I presented those yesterday.

Mr. DINGELL. I will certainly make it my business to study those very carefully.

Mr. LEE. I want to point out that my suggestions—I might mention them—one is of course to pay the full cost of research for the Government, and the other is to set up a fund at each school for basic research to be administered by the school but audited by the Government to make sure the money is spent properly. Those are my two suggestions in a nutshell.

Mr. DINGELL. I shall go over these very carefully.

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Thank you very much.

Mr. WILLIAMS. Mr. Schenck?

Mr. SCHENCK. I am sorry I missed his testimony because of a long-distance call.

Mr. WILLIAMS. Mr. Neal?

Mr. NEAL. I have no further questions. I think I discern from your statement that you believe it is far more economical and more effective if basic research is approached from the standpoint of interested applicants vying on a contract basis rather than to expect great returns from a large number of voluntary scholarships; is that your idea?

Mr. LEE. No, I think you misunderstood me there. I said this: That basic research is essentially research of an individual or a very small group of individuals. You cannot make up for ability by quantity. In other words, you cannot expect to get increased results by adding more and more engineers or scientists to a basic research program.

Mr. NEAL. And you think that can be done better on an individual contract basis?

Mr. LEE. Yes, sir.

Mr. NEAL. Thank you.

Mr. WILLIAMS. Thank you very much, Doctor.

Mr. LEE. Thank you.

Mr. WILLIAMS. At this time we are pleased to welcome another of our old friends, Dr. Alan Waterman, Director of the National Science Foundation.

It is always a pleasure to have with us Dr. Waterman.

STATEMENT OF ALAN T. WATERMAN, DIRECTOR, NATIONAL SCIENCE FOUNDATION, ACCOMPANIED BY WILLIAM J. HOFF, GENERAL COUNSEL

Mr. WATERMAN. Thank you, sir.

Mr. WILLIAMS. I believe you have a prepared statement?

Mr. WATERMAN. Yes, I have, Mr. Chairman.

Mr. WILLIAMS. You may proceed.

Mr. WATERMAN. Gentlemen, I might say first that Mr. William Hoff, General Counsel of the National Science Foundation is with me this morning.

Mr. Chairman and members of the committee, it is a great pleasure to be able to appear before you today to discuss some of the problems relating to science and scientific research. These are indeed important matters, and the decisions made by your committee will, of necessity, have a substantial impact on the progress of science and technology in the United States.

This year I might say that I had a visit from a man who is a world traveler, a world observer in all the countries of the world, and he remarked on the fact that he found it rather astonishing after his trip that there was one subject on which all nations now agree, and that is the importance of science and technology for their future, whether for defense or for their economic strength, and that illustrates the stage of what sometimes now is called the space era.

The agenda set forth in your announcement of April 7, 1958, indicated the committee's particular interest in certain legislation introduced in the House which in one way or another would amend the National Science Foundation Act of 1950. However, before

discussing the particular matters raised by these bills, I would like to state that, as an absolutely essential ingredient of assuring maximum progress in science, we must devise methods to make certain that the Nation will have an adequate supply of highly competent scientists and engineers. This involves much more than getting intelligent people into college, particularly since the postwar low in college population is behind us and we anticipate that by 1970 the college enrollment should be at least twice that of today.

It requires the identification of persons with aptitude for science and mathematics and that a certain number of such persons be interested in undertaking careers in science and engineering. It requires that these individuals have a good background in the basic subjects necessary for advanced study in the particular field of their choice and it requires that they receive competent training. All of these requirements presuppose a sufficient supply of well qualified teachers who can stimulate an interest in science and engineering in their pupils while providing the necessary groundwork for their future studies.

Another aspect of this problem is that teachers are not the only persons who can encourage interest in science as a career. The individual's home life and family interests are a very strong factor in determining the choice he makes. It is, therefore, important, we believe, to get the general public to become aware of what science is and what it can do. If the average citizen is educated in this manner, it will increase our chances of getting qualified people to go on to college and into engineering or into graduate study in science.

Increasing the interest of the general public in science also, we believe, would have a beneficial effect on both public and private support of science and science education through their increased understanding of science's needs. Furthermore, the findings of science are raising social problems which can be coped with only by an understanding and well-informed public.

This last point, I believe, is quite important. Science is progressing so rapidly these days that it will discover important and highly significant facts and items which can be used for the sake of society or for the country. These will pose big questions. We have seen some of them already. So it seems to me quite important to be sure that the people of the country understand in a general way what science is doing in order that when the questions arise, which they really alone can decide, namely, what are we going to do about it, they will have a good background for an intelligent opinion.

I have gone into this at some length because I want to emphasize the fact that merely providing money for support of a particular research project is not the whole answer. To summarize, we need quality in three areas: In native ability—this, of course, we have in abundance—and we must be able to identify and motivate these people; in training; and in performance. This is quality in all those three aspects. Support of research is, of course, necessary but, without the trained people, we can do nothing.

Under these circumstances it is our view that, while numbers are important, the more significant problems lie in the area of science teaching and in providing the highest quality training that we can. Furthermore, other fields besides science have a claim on the limited pool of highly capable young people. They, incidentally, may come from any background whatever, of course.

For these reasons we have not favored a scholarship program limited to students of science and engineering, but believe that any scholarship program which is instituted through Federal support should be a general one, as has been proposed in the administration's education bill, H. R. 10278.

The emphasis of the Foundation has, therefore, been upon efforts designed to improve the subject matter competence of science and mathematics teachers through its institute and fellowship programs, through support of efforts designed to improve science courses, and through attempts to encourage able students to undertake careers in science and science teaching by support of programs of visiting scientists, traveling science libraries, and other efforts to provide information to high school and college students and to encourage their interest. The Foundation's program in support of basic scientific research affords invaluable training to graduate students who assist in the work under the guidance of seasoned investigators.

If, of course, in the future, the number of science and engineering students appears less adequate than today, we would feel that other measures should be taken. In any event, the administration bill would provide approximately 10,000 scholarships a year to able students and would give a preference to those students with a good background in science and mathematics.

This program would indicate Federal concern with the need to create higher national standards in education and would give integrity to the proposed program, also contained in the administration bill, for early identification and guidance of able youth.

Up to this point I have addressed myself to a discussion of the production of qualified people from whom must come those who will do scientific research, engineering work, and teaching. It, of course, is perfectly apparent that these people must have the tools with which to carry on their activities. And this has to do with quality of performance, that I mentioned earlier.

These tools include very costly facilities, very often, many of them beyond the ability of a university or group of universities to finance. Financial support for facilities primarily for basic research is relatively more difficult to obtain than is support for facilities of an applied and developmental character, because financial incentives are usually not apparent enough so as to encourage industrial and other private funds for support of basic research.

Furthermore, there is very little private philanthropic support being provided for the additional or improved basic research facilities needed in many scientific fields.

The normal procedure leading to support for a particular capital research facility is that, initially, a group of scientists working in the field makes a study to determine the desirability of such a facility. If this study—and they acquaint us with the conclusions—if this study indicates and the Foundation determines, that a facility of this sort would be desirable from a scientific point of view, funds are then provided for a feasibility study to determine its practicality, its physical requirements, its schedule, and its estimated cost.

If the results of the feasibility study, judged in the light of other policy considerations, indicate that Federal support should be provided, it is at this point that considerable delay may occur. I would

estimate that as much as a year may elapse before the necessary estimates can receive appropriate action by the Federal agency concerned, by the Bureau of the Budget, and by the Congress. A delay at this point can cause a serious loss of scientific momentum. It would be highly desirable, at the time the feasibility study is concluded, to be able to proceed smoothly into the process of construction.

In addition, I might mention that rising costs or changing scientific developments may necessitate requesting additional funds, thereby causing delay in completion of the facility because of the need to carry out usual budgetary and appropriation procedures.

These problems are brought into focus by H. R. 10293, which would establish in the Treasury of the United States a national scientific research reserve fund in the authorized amount of $200 million, plus any additional amounts which may be appropriated therefor. Expenditures from the fund would be authorized by a vote of the Executive Committee of the National Science Board, provided the Committee finds that the initiation or continuation of each project for which expenditure from the fund is approved is of sufficient importance and urgency in its opinion to justify an immediate expenditure without carrying out the usual budgetary and appropriation procedures. A report on the status of the fund would be required annually from the National Science Board following its receipt of the annual report of the Executive Committee.

I believe that the general principle of H. R. 10293, to permit the prompt prosecution of important and urgent research projects without delay or interruption, is good. However, in my opinion, such a fund should be used primarily for basic research support and should be available for support of applied research activities only as an exception, in what might be termed unique situations requiring highly urgent action in the national interest. If the fund were generally made available for emergency applied research support, we believe that, because of the greater financial requirements and the greater apparent urgency of applied research, the demands upon the fund might be so great as to seriously impair its usefulness for extremely urgent basic research.

At this point, I would like to mention that, if legislation such as H. R. 10293 were enacted, the Foundation would undoubtedly wish to establish regulations governing claims upon the fund so as to prevent its use merely as a matter of convenience for those projects which could well be financed in the normal manner.

Other alternatives to the mechanism proposed in H. R. 10293 merit serious consideration. For example, another way to accomplish the desired objective could be through an increase in the Foundation's appropriations with a portion of such appropriations earmarked as a mobile reserve fund for urgent projects.

There is one final matter, gentlemen, to which I would like to address myself. It pertains to legislation requested by the National Science Foundation, H. R. 11257. Generally speaking, this proposed legislation would make certain technical changes in the National Science Foundation Act of 1950 in order to promote greater efficiency of operation.

At this time, if I may, I would like to submit for the record, an analysis of this proposed legislation.

(The document follows:)

NATIONAL SCIENCE FOUNDATION ANALYSIS OF A DRAFT BILL TO AMEND THE NATIONAL SCIENCE FOUNDATION ACT OF 1950, AS AMENDED

There is set forth below an analysis of each section of the National Science Foundation Act of 1950 which would be amended by the proposed legislation. At the end of each section analysis, the section itself is quoted, with omitted material is enclosed in black brackets indicated by new material is printed in italic.

Section 1

The changes proposed for section 4 (d) and section 4 (e) of the National Science Foundation Act of 1950 relate to the annual meeting of the Board and are requested because of the fact that at the present time elections of officers of the Board for 2 years must take place at the annual meeting in December, whereas the terms of one-third of the members of the Board expire every second year on May 10. Accordingly, elections must presently be held 5 months before there is a change in the Board membership and, among the candidates for office, there often are those whose terms are expiring in the subsequent May. It would be desirable, therefore, to have the annual meeting after the new members are appointed and confirmed by the Senate so that the Board may elect its officers with knowledge of its composition for the ensuing 2 years. The latitude in setting the actual date is to permit the accommodation of as many members as possible in order to assure the fullest possible attendance at the annual meeting. The language of the sections follows:

"SEC. 4. (a) The Board shall meet annually [on the first Monday in] *on a day during the last two weeks of* [December] *May* and at such other times as the chairman may determine, but he shall also call a meeting whenever one-third of the members so request in writing. A majority of the voting member of the Board shall constitute a quorum. Each member shall be given notice, by registered mail mailed to his last-known address of record not less than fifteen days prior to any meeting, of the call of such meeting.

"SEC. 4. (e) The first Chairman and Vice Chairman of the Board shall be elected by the Board to serve until the first Monday in December next succeeding the date of election at which time a Chairman and Vice Chairman shall be elected for a term of two years. Thereafter such election shall take place at the *second* annual meeting occurring [at the end of] *after* each such [term] *election*. The Vice Chairman shall perform the duties of the Chairman in his absence. In case a vacancy occurs in the chairmanship or vice chairmanship, the Board shall elect a member to fill such vacancy"

Sections 2 and 3

The changes proposed for section 5 (b), section 6 (a) and section 6 (b) of the National Science Foundation Act of 1950 are related to the same purpose. At the present time, the Board must approve the award of each fellowship and each grant or contract for basic research. This rigid requirement has posed serious problems for efficient operation in several instances. For example, when grants were being made for supplies for the scientific expedition to Antarctica in connection with the International Geophysical Year, time was of the essence. The lack of a Board meeting at which a contract or grant could be approved at the proper moment was an obstacle to assuring the timely arrival of equipment for the scientists. Under the proposed change, it is contemplated that the Board might delegate specific authority to its Executive Committee or to the Director to approve grants for contracts between meetings of the Board in certain situations. The change in the required size of the Executive Committee is suggested for the purpose of giving the Board authority to constitute a smaller Executive Committee which could more easily be assembled for emergency action. In any event, the Board would still retain complete power to grant such authority or not as the whole Board saw fit. The language of the sections follows:

"SEC. 5. (b) In addition to the powers and duties specifically vested in him by this Act, the Director shall, in accordance with the policies established by the Board, exercise the powers granted by sections 10 and 11 of this Act, together with such other powers and duties as may be delegated to him by the Board; but no final action shall be taken by the Director in the exercise of any power granted by section 10 or 11(c) unless in each instance the Board has reviewed and approved the action proposed to be taken [.] , *or such action is taken pur-*

suant to the terms of a delegation of authority from the Board to the Director or to the Executive Committee."

"SEC. 6. (a) The Board is authorized to appoint from among its members an Executive Committee, and to assign to the Executive Committee such of the powers and functions granted to the Board by this Act as it deems appropriate; except that the Board may not assign to the Executive Committee the function of establishing policies [,] . [or the function of review and approval (except review and approval of minor modifications of contracts or other arrangements previously approved by the Board), to be exercised by the Board in accordance with section 5(b).]

"(b) If an Executive Committee is established by the Board——

"(1) Such Committee shall consist of the Director, as a nonvoting ex officio member, and *not less than five nor more than* nine other members elected by the Board from among their number."

"(2) The term of office of each voting member of such Committee shall be two years, except that (A) any member elected to fill a vacancy occurring prior to the expiration of the term for which his predecessor was elected shall be elected for the remainder of such term; and (B) the term of office of four of the members first elected after the date of enactment of this Act shall be one year.

"(3) Any person who has been a member of such Committee for six consecutive years shall thereafter be ineligible for election during the two-year period following the expiration of such sixth year.

"(4) The membership of such Committee shall, so far as practicable, be representative of diverse interests and shall be so chosen as to provide representation, so far as practicable, for all areas of the Nation.

"(5) Such Committee shall render an annual report to the Board, and such other reports as it may deem necessary, summarizing its activities and making such recommendations as it may deem appropriate. Minority views and recommendations, if any, of members of the Executive Committee shall be included in such reports."

Section 4

The deletion of the words "accredited" and "of higher education" in section 10 of the National Science Foundation Act of 1950 is intended to take care of the relatively rare situation where the successful competitor for a fellowship wishes to study or work at a research institution in his field which is not an educational institution, for instance, at one of the National Institutes of Health. It is felt that, where the scientists judging the merit of the prospective fellow and his course of study or work believe that the applicant's proposal is sound, it is undesirable to limit his choice of institution in every case to an educational institution. The addition of the words "demonstrated and potential" in section 10 is for purposes of clarification. The language of the section follows:

"SEC. 10. TheFoundation is authorized to award, within the limits of funds made available specifically for such purpose pursuant to section 16, scholarships and graduate fellowships for scientific study or scientific work in the mathematical, physical, medical, biological, engineering, and other sciences at *appropriate* [accredited] nonprofit American or nonprofit foreign institutions [of higher education] selected by the recipient of such aid, for stated periods of time. Persons shall be selected for such scholarships and fellowships from among citizens of the United States, and such selections shall be made solely on the basis of *demonstrated and potential* ability; but in any case in which two or more applicants for scholarships or fellowships, as the case may be, are deemed by the Foundation to be possessed of substantially equal ability, and there are not sufficient scholarships or fellowships, as the case may be, available to grant one to each of such applicants, the available scholarship or scholarships or fellowship or fellowships shall be awarded to the applicants in such manner as will tend to result in a wide distribution of scholarships and fellowships among the States, Territories, possessions, and the District of Columbia."

Section 5

The changes proposed in section 11 (c) and section 11 (d) of the National Science Foundation Act of 1950 are technical and are intended to bring these sections in accord with the changes proposed for section 13. The change proposed in section 11 (e) is for purposes of clarification. At the present time, the law does not, for instance, specifically authorize the acquisition of property by condemnation or disposition of property, such as a scientific facility, by grant. These powers, however, seem to be inherent in the act so that the Foundation would have authority to support the conduct of basic research by acquiring

property through condemnation or through assisting an institution to acquire a necessary facility held by the Foundation. It is, however, suggested that this section be clarified to make the authority explicit. The language of the sections follows:

"SEC. 11. The Foundation shall have the authority, within the limits of available appropriations, to do all things necessary to carry out the provisions of this Act, including, but without being limited thereto, the authority—

"(c) to enter into contracts or other arrangements, or modifications thereof, for the carrying on, by organizations or individuals in the United States and foreign countries, including other government agencies of the United States and of foreign countries, of such [basic] scientific [research] activities as the Foundation deems necessary to carry out the purposes of this Act, and, at the request of the Secretary of Defense, specific scientific [research] activities in connection with matters relating to the national defense, and, when deemed appropriated by the Foundation, such contracts or other arrangements, or modifications thereof, may be entered into without legal consideration, without performance or other bonds, and without regard to section 3709 of the Revised Statutes;

"(d) to make advance, progress, and other payments which relate to scientific [research] *activities* without regard to the provisions of section 3648 of the Revised Statutes (31 U. S. C., sec. 529);

"(e) to acquire by purchase, lease, loan, [or] gift, *condemnation, or otherwise*, and to hold and dispose of by *grant*, sale, lease, [or] loan, *or otherwise*, real and personal property of all kinds necessary for, or resulting from, the exercise of authority granted by this Act."

Sections 6, 7, and 8

The changes proposed in section 13 of the National Science Foundation Act of 1950 are intended to permit the Foundation, with the approval of the Secretary of State, to support or to facilitate international scientific activities rather than merely to cooperate in research activities, and to award scholarships and fellowships or make other arrangements with foreign nationals for scientific study or scientific work. At the present time, the Foundation cannot grant scholarships or fellowships to foreign nationals and this amendment would remove this disability. The new section 13. (b) is designed to give the Foundation statutory authority to carry out scientific activities abroad in the interest not only of science but of our foreign relations. This authority would only be exercised where such undertakings are deemed to be in the interest of the United States, and with the approval of the Secretary of State. In the present era, no one country can have any monopoly of scientific talent and it is essential that we place ourselves in a position to cooperate more effectively with scientists abroad. The language of the sections follows:

"Sec. 13. (a) The Foundation is hereby authorized to [cooperate in] *facilitate* any international scientific [research] activities consistent with the purposes of this Act and to expend for such international scientific [research] activities such sums within the limit of appropriated funds as the Foundation may deem desirable. The Director, with the approval of the Board, may defray the expenses of representatives of Government agencies and other organizations and of individual scientists to accredited international scientific congresses and meetings whenever he deems it necessary in the promotion of the objectives of this Act. *In this connection, with the approval of the Secretary of State, the Foundation may undertake programs granting scholarships and fellowships to, or making other similar arrangements with, foreign nationals for scientific study or scientific work in the United States or foreign countries without regard to section 10 or the affidavit of allegiance to the United States required by section 15 (d) (2) of this Act.*

"(b) *The Foundation is also authorized, with the approval of the Secretary of State, to undertake programs providing for the conduct or facilitation of such other scientific activities abroad as are deemed to be in the interest of the United States.*

"[(b)] (*c*) (1) The authority to enter into contracts or other arrangements with organizations or individuals in foreign countries and with agencies of foreign countries, as provided in section 11 (c), and the authority to [cooperate in] *facilitate* international scientific [research] activities as provided in subsection (a) *and* (*b*) of this section, shall be exercised only with the approval of the Secretary of State, to the end that [such] authority *to undertake such programs* shall be exercised in such manner as is consistent with the foreign policy objectives of the United States.

"[(b)] (c) (2) If, in the exercise of the authority referred to in paragraph (1) of this subsection, negotiation with foreign countries or agencies thereof becomes necessary, such negotiation shall be carried on by the Secretary of State in consultation with the Director."

Section 9

The new section 14 (j) proposed to be added to the National Science Foundation Act of 1950 is designed to make it possible for the staff or the Foundation to keep up with the latest developments in their fields. At times, additional training or attendance at meetings may be required to assure that the Foundation's employees can maintain the highest competence and knowledge in their fields. The language of the section follows:

"*(j) To the extent he finds it will contribute to the more effective functioning of the National Science Foundation, the Director is authorized to conduct or provide training and to assign employees for training or attendance at meetings at Federal or non-Federal facilities, including public or private agencies, institutions of learning, laboratories, industrial or commercial organizations or other appropriate organizations or institutions, and, if he deems it appropriate, to pay in whole or in part, the following: the salaries of such employees for the period of training or attendance; the cost of their transportation and per diem in lieu of subsistence in accordance with the Travel Expense Act of 1949, as amended; necessary expenses incident to their training including tuition, study materials, and other customary expenses. Appropriations or other funds available to the National Science Foundation for salaries and for expenses shall be available for the purposes of this subsection.*

"An employee who accepts assignment for training for more than 15 days at any one time shall agree in writing to remain in the Government service, unless involuntarily separated therefrom, for a period equal to three times the length of any time off with pay granted without charge to annual leave for the purpose of such training. Any such trainee who fails to fulfill such agreement shall be required to reimburse the Government for whatever portion of the travel, subsistence, tuition, fees and related expenses paid by the Government during such training the Director determines to be appropriate."

Mr. WATERMAN. There is one aspect of this legislation which I believe to be of particular significance. In the bill it is proposed that the Foundation Act be so amended as to broaden the scope of the Foundation's authority with regard to international scientific activities. These proposed amendments are intended to improve the exchange of scientific information among scientists in the United States and those in foreign countries and to facilitate scientific activities abroad which we believe will result in additional benefit to the scientific community in the United States and in the free world. Thus, we are requesting authority to make fellowship awards to foreign nationals for scientific study or scientific work in the same manner as we now do to American citizens.

I would like to emphasize that, under the terms of the bill, such activities would be undertaken only with the approval of the Secretary of State so as to make certain that they are in accord with the foreign policy objectives of the United States.

The bill would also authorize the National Science Board to delegate specific authority to its Executive Committee or to the Director to approve grants or contracts between meetings of the Board in certain situations as determined by the Board. At the present time the Board must approve the award of each fellowship and each grant or contract for basic research. This rigid requirement has posed problems for efficient operation in several instances where time was of the essence. With the greatly increased load on the Foundation, this proposed amendment has become a necessity.

That concludes my statement, Mr. Chairman. I shall be happy to answer any questions that you might have.

Mr. WILLIAMS. Thank you very much, Dr. Waterman.

Did I understand that the bill introduced by Mr. Harris, which is H. R. 11257, is considered the Agency's bill?

Mr. WATERMAN. This is completely in accord with the Agency's views and the administration, Mr. Chairman.

Mr. WILLIAMS. A moment ago we discussed your suggestion that we bring in foreign scientists, and you qualified that by subjecting this to approval by the Secretary of State to make certain that they are in accord with foreign policy objectives of the United States? I wondered if Mr. Dulles knows what the foreign policy of the United States is. Certainly, I don't. You don't have to answer that.

Mr. Dingell?

Mr. DINGELL. Doctor, I was interested in your remarks on another administration bill. I have forgotten what the number is. It is around H. R. twelve thousand and something. I assume that is the administration bill for aid to students on the graduate level generally. Am I correct? That bill is not before this committee but has been referred.

Mr. WATERMAN. I am not sure to which you refer.

Mr. DINGELL. I think it was 12078. I notice it is not on the list of bills presently before this comimttee. That was before the House Education and Labor Committee.

Mr. WATERMAN. Yes. That is Senator Smith, and in the House, Mr. Elliott. Yes, sir; I know that bill.

Mr. DINGELL. I was particularly interested in a number of things that I raised here. I am sure you heard the testimony of the distinguished witness who preceded you, Dr. Lee, from Rensselaer?

Mr. WATERMAN. I did not hear him yesterday; just this morning.

Mr. DINGELL. Did you notice that he and I went into the question of contract grants versus fellowships?

Mr. WATERMAN. Yes.

Mr. DINGELL. As opposed again to the general operation of just granting funds to students regardless of need or qualification. I was wondering, assuming that we have only a limited number of dollars to spend, what is the best way to spend this money? To grant it broadcast to anybody who is needy; do we grant it to certain qualified students perhaps on an examination or scholarship basis, or do we limit it to fellowships or fellowships by contract? Where is the best way of doing that?

Mr. WATERMAN. The best is a balanced system, in my experience, and I have had quite a number of years of it. One method consists in support by means of research grants for work on a particular research problem in science, which is headed by a very competent investigator or a group of them. That is one type of research support.

And the other is where the stipend goes to an individual, and that is what we term a fellowship. The Foundation does both and we have large programs in both.

The first one, you see, is judged on its merits as a scientific problem to be solved and in competent hands. And in our case this goes to the institution for the man on that project. It is paid to the institution for him, and the things he needs.

Among them, he needs young assistants, and in that connection he employs graduate students to work on the grant, and they get, therefore, the research experience of working with him. But the emphasis,

you see, is solving a scientific problem, and we select from the applications we get those that we think are best and give money for that purpose. That is the grant mechanism.

The other mechanism, the fellowship mechanism, is traditionally one of the best ways of encouraging especially able young scientists, and the money then, say in the case of a predoctoral fellowship, goes to a graduate student as a stipend and, in addition, pays his tuition fees so that he can pursue graduate studies at the institution, which lead to an advanced degree.

So the difference is that the money goes to a person for study and for training in research. The actual research he is going to accomplish he is free to do in any way that he chooses, subject of course to the consultation and supervision of the graduate faculty.

The fellowship plan is also extremely useful for senior scientists, and in effect this allows them to concentrate on their particular specialty in research for the period they hold the fellowship. It might give them leave of absence from their institution to study at some other institution, or study abroad, and do research in the line of their specialty.

So you see the distinction. The research grant is done for the sake of the merit of a scientific problem, which is important, and which is in capable hands, and which employs people to work on it.

And in the other case it goes to the individual to give him the possibility of pursuing study or research in the way which he sees best as an individual. They are both very helpful.

In the history of science and indeed in other fields a limited number of fellowships have been very stimulating to young people, and also to senior people. It gives them a chance to concentrate for a short period on the research and study which they need, and their time is not taken up with the ordinary duties which they would otherwise have.

Mr. DINGELL. You refer at the top of page 7 to the alternatives to the Dawson bill, the Dawson bill being to set up a national science reserve fund of $2 million for the purpose of making grants to accelerate projects of scientific value and so forth. One way you suggested would be for additional appropriations for the National Science Foundation.

Doctor, would you be able to tell me how you have been faring with the Appropriations Committee insofar as your requests, and especially insofar as requests of this sort, since the Dawson bill is essentially an authorization program and would require further appropriation activity.

Mr. WATERMAN. Yes. As to how we have been faring with this, the House action on the 1959 budget has resulted in providing us with the funds for our regular basic research program for which we asked. There was no cut there. It did, however, limit us with respect to research facilities, important research facilities which are needed to carry on research in special fields, such things as research reactors, large electronic computers, solar telescopes, and things of that type.

We are very severely limited in that. In fact, the House eliminated those from our budget request. We received no cut in the basic research support fund itself but these funds are not available for major

facilities. To answer your first question—the alternative scheme which I mentioned—if in our budget request a certain percent of the money which we had for the support of basic research plus facilities, could be earmarked for emergency use in this way, that could be an alternative and might provide a simpler mechanism perhaps than that contained in the Dawson bill.

I would like to speak a little further to that if I may, to the need for this kind of thing. Perhaps the outstanding case recently was when sputnik went up last fall. Every agency had received its normal appropriation and there was nothing it could do until the Congress met and a supplemental could be turned in. There were many things we should have done at once, such as modifying our satellite program.

Mr. DINGELL. Radio equipment?

Mr. WATERMAN. Yes, to follow the Russian satellite which was broadcasting on a different wavelength.

Mr. DINGELL. Were you unable to do that because of lack of money?

Mr. WATERMAN. We got on as fast as we could. In the Foundation we were not able to secure funds to carry this on further until the first supplemental of $2 million which we did get very promptly, but only, you see, after we could get the request in. So that months elapsed when it was a real handicap that none of us could do as much as we felt we should.

Similarly, in connection with a large facility, let's say a large nuclear accelerator, a scientist just discovers a very important effect which he would like to investigate thoroughly. He may need an accessory piece of equipment for that which may cost hundreds of thousands of dollars.

An agency may not be able to honor that right away; their funds are pretty heavily committed, and ours are certainly in that situation. So if we had a fund that we could draw upon after, of course, a check to be sure this was really highly significant, then we would not have to wait for a supplemental or some other way of handling it.

In general, of course, I am sure that we would all agree that the use of a fund like this should be confined to something which cannot be adapted to the usual budget procedure, that one would have to check very carefully to be sure that it was important, and also check to be sure that this was not involving the Government in a continual commitment.

There was another illustration recently, too, where the United States, you recall, declared its intention to carry on a scientific program in the Antarctic recently, and when that decision was reached it was quite necessary to make sure that the Navy Department, which carries on the logistic operations there, had in plenty of time the equipment which was going to be needed to outfit the stations for continuing the program after the IGY year was over. Also that men had to be secured and put through a 4- to 6-month period of training so that they would be available to go there for that period.

So there again, if initial funds could have been provided at once, you see, that would have saved the difficulty of having to rush through a very urgent supplemental bill—which at best consumes a substantial amount of time.

Mr. DINGELL. Referring to Dr. Lee's statement again, he referred to some things that I think are rather common knowledge. For example, tuition at Rensselaer is about $1,200 a year. He said on page 4:

Tuition is $1,200 per year.

He said that—

the cost of tuition at Rensselaer Polytechnic Institute is approximately $1,800 a year. There is, then, a difference of approximately $600 per student per year which must be made up from sources of income other than tuition. Income from endowment is approximately $240 per student per year at Rensselaer. This leaves a deficit of approximately $360 per student per year that must be made up in some way; usually through gifts and grants. I use Rensselaer only as an example; I could have used almost any other privately endowed college or university in the country and the example would have been essentially the same.

The point I am getting around to is this: This business of just giving fellowships and scholarships to schools is not a sufficient approach to the problem, because all we are doing is in effect multiplying the problems which the schools and universities face, the alternative being that they charge the full cost of the student rather than just the bare tuition, which does not meet the cost.

Would you care to comment on that?

Mr. WATERMAN. Yes, sir. This is a difficult question, I think. It is well known, as you say, that it costs much more for an institution to educate a student than the tuition charges or the charges that the university makes to him.

Mr. DINGELL. It is true in the case of almost every privately endowed and private school in the country, is it not?

Mr. WATERMAN. That is correct; yes. The question is whether the Federal Government should provide the universities with general funds, because in doing this one gets at once into the question of whether the Federal Government should give general aid to higher education which, as you know, has always been a matter which the Federal Government has been reluctant to do.

In the particular case of fellowships this would not go far, though, and it would insure that when a fellowship is awarded to a man and he goes to an institution, at least the institution does not lose by the fact that the man goes there.

While we have no such arrangement at present in our fellowship program, we are proposing in the fellowship plan for next year, that in addition to tuition charges, a sum go to the institution to make up in a general way the difference between the cost to them of the work there and what the fellow pays as tuition.

Our present fellowship programs do not do this.

Mr. DINGELL. Does that involve the administration bill before the Education and Labor Committee?

Mr. WATERMAN. That is in our own program in accordance with our budget request for 1959.

Mr. DINGELL. And will require no legislative action?

Mr. WATERMAN. It would require no legislative action.

Mr. DINGELL. Other than the action of the Appropriations Committee.

Mr. WATERMAN. I believe not—only a sufficient appropriation.

Mr. DINGELL. Thank you very much.

Mr. WILLIAMS. Mr. Bush?

Mr. BUSH. Dr. Waterman, do you have any knowledge of the number of scientists that are being turned out of our colleges today?

Mr. WATERMAN. Yes, we do have figures on that. We have just recently completed a study of the number of bachelors in science and doctors of philosophy in science a year. We can furnish that for you if you would like.

The impressive thing, of course, Mr. Bush, is that we know that somewhere along the line we are losing a lot of them. We know this from the fact that of the top 25 percent of secondary school graduates, only about 60 percent go on to college. So that 40 percent of the ablest are not going to college.

No one is going to insist that they go to college. That is their own choice. But many of them do not properly appreciate the advantages they would have, especially if they have high aptitude for a thing like science.

The industries know pretty well that if a person goes on and gets a specialized education in science, if he has aptitude for it, that he will go further with his company, he will be more productive, and that means that he will have a much more rewarding career. So if he can afford to take this time he will go much further in the end.

To offset that, jobs in technical industries are eagerly sought for now and they pay high salaries. So many a boy or girl, we find, feels that there is no need to go on to college, that he can get a good job and get promotions, so why do it? But the country is the loser by this because we badly need these trained people. And in the end they would gain themselves. That is a point that I would like to make in this same connection.

Mr. BUSH. Will you file that information with the committee?

Mr. WATERMAN. Yes, indeed. I will be very glad to.

(The information requested is as follows:)

BACHELOR AND DOCTORAL DEGREES IN SCIENCE AND ENGINEERING IN THE UNITED STATES

In the academic year 1956–57 there were granted in the United States approximately 39,000 bachelor's degrees in science and 31,000 bachelor's degrees in engineering. There were also granted, in the academic year 1956–57, 4,200 doctoral degrees in science and 600 doctoral degrees in engineering.

By 1960, it is estimated that approximately 437,000 bachelor's degrees will be granted annually in all fields and that roughly 20 percent of such degrees, or 87,000, will be in science and engineering. By 1970, it is estimated that 766,000 bachelor's degrees will be granted in all fields, of which approximately 153,000 will be in science and engineering.

With regard to doctoral degrees, it is estimated that, by 1960, 10,500 such degrees will be granted in all fields, of which approximately 50 percent, or 5,250, will be in science and engineering. It is further stimated that, by 1970, there will be granted 19,700 doctoral degrees annually in all fields, of which 50 percent, or 9,800, will be in science and engineering.

Mr. BUSH. There has been a lot of stress put on the fact that there is a great need of finding out who might be at fault. You stated a while ago that you have had a lot of experience working in the field of science. From the time you were a young man was it your desire to be a scientist?

Mr. WATERMAN. One can't generalize from a particular case. I started by being interested in mathematics in school. I like mathematical problems. I suppose that is a good test of whether one is interested in science; if you are interested in puzzles or anything of

that nature which requires solving. Anyway, my first interest was in mathematics, and I did not study science until I went to college. When I first studied physics that appealed to me and so I kept up the combination of physics and mathematics. But that wasn't until college in my case.

We have studied this and find that that is not true of most people. Most people's interest in science dates back to secondary school. Of course as you gentlemen know, it very often is related to a good teacher or a person that they admire at that time. A good teacher that they respect and who knows his subject well is really the best motivation that you have.

Certainly the reverse is true also, that if a boy or girl with a natural inclination toward science comes under a teacher who does not know science, then they are not going to touch it. The negative is important there as well, which is why we are emphasizing the need for competent teaching.

Mr. BUSH. I wonder if there is any special formula that one can follow to pick out these individuals as they go through their schooling, to be reasonably sure that they have the ability to become real scitentists, without wasting a lot of money on them.

Mr. WATERMAN. There are of course the testing services, the achievement and aptitude testing services that have now reached a pretty good point of efficiency. They say that they can identify ability in mathematics and science more clearly than in most other things.

I think probably the same thing would be true in the fine arts. It is easy to tell whether a boy or girl is good at music or painting. It is not as easy in science and mathematics. But they say they can identify this aptitude in that way.

If one wanted to be careful about it, he would, I am sure, add that if the science teachers also thinks so and the student's grades show it, and his interest, then you have a fair indication.

Mr. BUSH. Mr. Chairman, I would like to make a statement off the record.

Mr. WILLIAMS. Off the record.

(Discussion off the record.)

Mr. WILLIAMS. Mr. Loser?

Mr. LOSER. Dr. Waterman, have you considered Mr. Price's bill, H. R. 4218?

Mr. WATERMAN. Yes, sir.

Mr. LOSER. And the Van Zandt bill which is similar, I believe. They offered identical bills.

Mr. WATERMAN. Yes, sir.

Mr. LOSER. Do you have a firm opinion about those bills?

Mr. WATERMAN. Yes. I would be very glad to comment on those, Mr. Loser.

Mr. LOSER. I wish you would.

Mr. WATERMAN. The chief point, as I recall it, is the stipend of $500 as a prize for demonstrated ability in mathematics to high-school students. That was one of the chief features. This would be a very good way of stimulating those boys and girls who have interests in mathematics, and incidentally stimulating their teachers because if the boys and girls win prizes or do not win them the teachers of course find that this has an effect on their own activities.

Personally, we feel, the Foundation feels that since the administration now has a bill to provide scholarships in all fields, that this is a more desirable thing. The encouragement of mathematics is excellent and of course is a fine foundation for science and in particular for engineering. But if we can accomplish this in other subjects as well, the country needs specialists in other subjects, too. It needs those who are capable in other professional activities. And we feel, in other words, that the general scholarship plan would accomplish more than this would.

Mr. LOSER. Do you feel, then, that a monetary reward might be desirable?

Mr. WATERMAN. A monetary reward would be desirable, yes.

Mr. LOSER. But that it not be limited to mathematics?

Mr. WATERMAN. Yes. That's right.

Mr. LOSER. But that other fields of science be included?

Mr. WATERMAN. Yes, sir; as is the case in the administration bill, and in nonscientific fields as well.

Mr. LOSER. Thank you.

Mr. WILLIAMS. Mr. Schenck?

Mr. SCHENCK. Thank you, Mr. Chairman.

Dr. Waterman, I am tremendously interested in your statement which I tried to follow very closely.

We, as Members of Congress, are often in a difficult position. Most Members of Congress have some well-established information as to the need for educational opportunities and facilities. I emphasize that most of us, I am sure, do. At the same time we are also very aware of the cost of these things.

We know that all Federal grants and all Federal expenditures must come first from the people who pay the taxes. Of course, people who pay the taxes can reach us every 2 years, whereas they cannot reach, for want of a better term I will say "bureaucrats"—appointed officials I suppose, would be a better term—and therefore they are quite critical of some of these programs and each of us as Members of Congress.

In your statement, at pages 4 and 5, you talk about the studies of feasibility, and upon the completion of a feasibility study that your organization and similar organizations should be in position to make more or less immediate decisions. That puts us in quite a difficult position, because that gives appointed officials an opportunity to determine policies, and sometimes they are very costly policies.

Have you any suggestions as to how safeguards can be thrown up around those decisions of appointed officials?

Mr. WATERMAN. That is a very good question, Mr. Schenck. We understand that one fully. Of course, we would make a thorough review from the experts in the field and those of general experience. For example, we have in the Foundation statutory divisional committees which are associated with the major divisions in the Foundation, one for the mathematical physical and engineering sciences, one for the biological and medical sciences, one for scientific personnel and education.

Anything of this sort would be considered very carefully by them and by a subcommittee of them and experts that we would call in. Then, in addition, my own staff would study it from the standpoint of what would be appropriate for the Government to do, and then our Board—you know we have a 24-member Board, appointed by the

President and confirmed by the Senate, to which these matters are referred—would also make a special study of it. So we would make all the review that we could on it.

Formally the check could always be that there would have to be an accounting, a review of what had been done, and an agency that had a fund like this would be well aware of that. So that it would have to be careful of what it did, I am sure, and conform to those terms. That is the best safeguard I know.

I might say one other thing, Mr. Schenck, and this I feel is quite important for everyone to realize: With the present state of the world as we know, we simply cannot neglect our progress in science and technolgy. This is well known.

The question arises, can we afford to do the things that science says are important in the fields of technology, or will this make us get overextended; can we pay for all of this. That is a good question.

This is like a dilemma. Are we to do everything that we turn up and go bankrupt? That would never do, certainly. That would jeopardize the economy. Or are we to proceed in such a way that we accomplish only a part of what we think is possible because we are afraid that we cannot afford it. If we do that, then we jeopardize our security, because we have not done all that we could in the fields of science and technology, and that is important.

The answer to me is very clear. The subject of my presentation here and the subject of these bills is basic research. Basic research is relatively inexpensive. In this the man is looking for something new and original. This is what his reputation depends on. And he is not primarily concerned whether this is going to be useful or not. Someone else can find that out. He wants a new idea. He wants new data. He wants to discover more about the world.

I say that is inexpensive. At the present time the country as a whole is spending for basic research only about 4 percent of the total on research and development, so this is a relatively inexpensive thing to do.

We must do all that science can show us in the direction of the possibilities for further advance in technology. This is like an investment across the board. We know some of it will pay off but we can't be sure where. However, we don't dare not make the investment.

Having made the investment which does not cost much, then we should be very careful what we put the big money into in the way of development. We should be sure that these are entirely feasible and important, and that they don't go off to soon, because that is where money can be wasted.

So my answer is that we should support all the basic research that is in competent hands, which the scientists feel is important, and then select very carefully what, from those things opened up by the basic research, we as a country feel we can afford to do. And that seems to me to solve the general situation.

Mr. SCHENCK. Thank you very much.

You mentioned a certain date, last October, when sputnik was launched. If the National Science Foundation had had at its disposal at that time $200 million, could you have done anything substantially that you were not able to do until the Congress met and considered a supplemental?

Mr. WATERMAN. We could have made faster progress in the steps that we took.

Mr. SCHENCK. How much faster?

Mr. WATERMAN. That is very hard to say. Actually we wanted $2 million as soon as we could get it, and we didn't get this until February. This involves improving the network and the receiving instruments to find out from the satellites what they were doing, and in addition, speeding up our own program to be sure that we had the right kind of instrumentation ready to go forward and make our own observations.

These instruments also should take into account what had already been found in previous satellite flights so that we could extend our program. It is matters like that. I wouldn't be able to state how much difference it might have made in the time interval.

Mr. SCHENCK. That delay was approximately 3 months?

Mr. WATERMAN. Yes, sir.

Mr. SCHENCK. Was not advance intelligence available to the National Science Foundation from CIA and other sources that would have enabled you to have anticipated that event?

Mr. WATERMAN. Not with any precision. The forecasts only were that the Russians were working busily on the whole satellite problem, and that at some point they would be able to capitalize on it and be successful. But no particular time schedule, so far as I know, was known.

Mr. SCHENCK. You weren't then sufficiently aware to have anticipated that to the extent that you could have developed the necessary instrumentation?

Mr. WATERMAN. No, sir. I think not. We couldn't meet the situation until we were sure of what was needed to meet it. That, we didn't know until the event.

Mr. SCHENCK. My experience in education is that most parents believe their youngster is well qualified for something. Ten thousand scholarships would be a mere drop in the bucket, would it not, to meet any kind of such a demand? Would there not be a great deal of danger of Federal control of education when a lot of scholarships are made available?

Mr. WATERMAN. That is the reason, in my opinion, why it is well to keep the number down. This attracts attention to the need for people going on with their studies so that they can enlist in the ranks of highly trained professionals without making the country dependents upon fellowships, and it does see to it that some of the ablest have this opportunity at once. To go further than that might really get the Federal Government involved in higher education and make the universities dependent upon it.

Mr. SCHENCK. A very good friend of mine who is a Russian-born Jew was able to return to near his birthplace a year ago. Subsequently I had lunch with him and he told me that after the youngster goes to school the Russian Government takes over completely and decides what that youngster shall study, where, and when, and to what extent. Is that a desirable situation?

Mr. WATERMAN. Certainly not. No, indeed. Education should be in the hands of the individual guided by those who know the subject and know the field of education.

Mr. SCHENCK. Apparently it is, in the hands of those who know the subject, in the field of education of Russia. It takes the control of

the course of study of the youngster and the development of that youngster away from his folks and puts it entirely in an involuntary situation.

Mr. WATERMAN. No; I think our situation is much healthier where the local communities handle these matters, and if they don't go right they can correct them locally—our towns and our cities and States. This is where we should really see that that job is done, and backing them of course are the parents that are involved in their own children. They are the ones that are most interested.

If they are well apprised of the situation then they can help take steps that make it much easier for everyone. In fact, my thesis in this whole thing is that if the training in science is indeed important at these secondary levels, the most important thing to see is that the citizens and that the parents know this, because they know how to work locally in a way to get things done, much faster than others. The extent to which they succeed will make it easier for their towns and States to go along. But the actual choices should be left to the individual.

Mr. SCHENCK. I take it, then, that that is your basic reason for feeling that these scholarships should be quite limited in number?

Mr. WATERMAN. That is correct.

Mr. SCHENCK. So that the control of all education at the local school level should be within the local communities and the education under their State and local laws and not subject to interference by the Federal Government?

Mr. WATERMAN. Yes, sir.

Mr. WILLIAMS. Would you yield at that point?

Mr. SCHENCK. Yes, sir.

Mr. WILLIAMS. Dr. Waterman, I think you have made a very fine statement, that the responsibility for public education is at the local level. Isn't it also a fact that in the absence of an amendment to the American Constitution there is no specific authority presently for the Federal Congress to spend public money for purposes of public education?

Mr. WATERMAN. If you mean this in the sense of taking over the prerogatives of the local communities and the States——

Mr. WILLIAMS. No, sir. I mean under the Constitution itelf——

Mr. WATERMAN. I would certainly say no authority to take over the prerogatives of the local communities and States.

Mr. WILLIAMS. Wherein the powers of Congress are specifically delineated, there is no authority for Congress to spend public tax money for purposes of public education. And under the 10th amendment that is reserved exclusively to the States and to the people, respectively; isn't that correct?

Mr. WATERMAN. I am not an authority on that, Mr. Chairman. My feeling is this: That, as I have just said, I believe that education should be in the hands of the local communities and the States. But if we have an emergency in any matter relating to, say, research or science, which involves training, then it seems to me it is the Federal Government's duty to find out the facts, to make the surveys, to make these known to the people, and to assist in such ways as providing fellowships to attract attention to the problem and see to it that the gifted people can be found, and then to perform experimental operations which may help the States and local communities to find the answer.

It seems to me this is indicated, provided you have an emergency.

Mr. WILLIAMS. Doctor, I quite agree with respect to what you may term desirability on your feeling that it might be incumbent upon the Federal Government to do this or that. However, I am greatly concerned with the current trend away from the constitutional limitations imposed upon the authority of the Federal Government.

In the absence of an amendment to the Constitution as the Constitution stands today, it has never been shown to me that the Federal Government has any legal right under that Constitution—which is our basic law and was intended as a limitation on the Government in power—to spend Federal tax moneys for purposes of public education.

Regardless of how desirable it might be, or how necessary it might be considered in some quarters, is it possible for anyone—and you have your counsel there, who I think is qualified to answer this question—to point out specific authority granted in the Constitution for that purpose, and if there is such authority to state that is being compatible with the provisions of the 10th amendment?

I am very serious about that. I think that perhaps your counsel would be in a better position to answer that than you.

Mr. WATERMAN. Before I call on Mr. Hoff, Mr. Chairman, let me say that while I don't know the legal phrases for it, my opinion on this matter would be that if a matter touches the national security, or if a matter arises where the States and local communities are not able to produce effective action, then if the strength of the country is involved it will be proper and necessary for the Federal Government to do the things which the States are not able to do by themselves. That would be my own wording of it.

Mr. Hoff?

Mr. WILLIAMS. I realize that has been a long-accepted theory among a great number of people in this country. But I would like to have some comment on the compatibility of that with the Constitution itself.

Mr. SCHENCK. Mr. Chairman, I think you are entitled to have that kind of an explanation, and I hope that counsel will be able to give that answer. But one of the things that concerns me particularly is that Dr. Waterman has referred several times to emergencies, to unexpected developments, to urgent situations, and so on. Aside from the constitutionality question that you raised, and perhaps very properly so, I cannot quite understand how, with a fund of $200 million, you can, with certainty, pour ability, education, understanding, and so forth into so many people to meet an emergency situation. That is one of the points that I have difficulty in rationalizing.

Mr. WATERMAN. As I understand it, this sum is only authorized, Mr. Schenck——

Mr. SCHENCK. Any sum.

Mr. WATERMAN. In my opinion it wouldn't need to be that large and shouldn't by, if we start it as an experimental fund. But presumably it would only be used when really necessary

Mr. SCHENCK. What I have reference to, Dr. Waterman, is that as of the birth of Sputnik No. 1, if you had had X number of dollars available that day, would it have been possible to suddenly develop people and things which were capable of analyzing the effects of Sputnik No. 1?

Mr. WATERMAN. We had the people, and if we had had immediate funds they could have turned to the problem directly in front of

them, which they saw for the first time, and could have produced instrumentation and systems of dealing with it which they had not done up to that time.

We had the people, and they could have turned to it. Hopefully, we could have had others, and I am sure there would have been many volunteers at the time.

Mr. SCHENCK. Mr. Chairman, I didn't want to change this train of thought.

Mr. WILLIAMS. That is all right.

Mr. SCHENCK. I wanted to find out whether or not an additional sum of money could guarantee that the United States Government could meet the challenge with which it was confronted, or with which it may be confronted in the event of an emergency, merely by the presence of authorized dollars on hand. It is my understanding that the President can call the Congress into emergency session at any time that it is in recess. If it were felt that 3 months' delay was a serious question, it could have been called into session 2 days after sputnik was launched, if that had been felt completely necessary.

Mr. WATERMAN. I might, Mr. Chairman and Mr. Schenck, relate a little story which we got from Europe at the time of the Geneva convention. I don't want to say that we should copy the Russians at all, but they have a great advantage in high-priority matters of making very quick decisions. For example, one of our scientists talked to the man in charge of their very big nuclear accelerator—which is larger than ours, by the way—and asked how he was able to get the money to do this. He said, "I had no relation to the money getting at all." Our man asked, "How did you succeed in getting it?" He said, "I simply said that we needed it, and we began to get all we needed." Just like that.

Mr. SCHENCK. Our form of government is the price we pay for the freedom and privileges that we enjoy.

I appreciate your very splendid answers, Dr. Waterman.

Mr. WATERMAN. Thank you. You understand that this sum of money, which is mentioned in the Dawson bill, would be for research matters rather than training. It is not intended to be used for training, really, but for instrumentation and so on.

Mr. SCHENCK. I understand. I was pleased with your statement with regard to the necessity for well-qualified and properly trained and devoted teachers, because I think that is the very basis of our need. A good teacher can do a good job teaching in a church building or on a park bench or somewhere else, where a poor teacher cannot do a good job in a marble hall.

I think we ought to do whatever we can to encourage the quality and increase the number and ability and devotion and dedication of teachers.

Mr. Chairman, thank you very much. I am sorry to have intruded on your question.

Mr. WILLIAMS. That is all right.

It is a quarter to 12 now.

There is an international WPA in operation on the floor of the House this afternoon, which a lot of us are very much interested in. I have talked with Dr. Neal. Dr. Neal indicates that he has quite a number of questions that he would like to develop, certain matters that he would like to develop.

And then, of course, I have quite a number of matters that I would like to develop, Dr. Waterman. It is quite obvious that we can't conclude your testimony this morning, and also it would be impossible to hear Mr. Brode this morning.

I wonder if it would be possible for you gentlemen to come back at some later date that would be mutually agreeable?

Mr. WATERMAN. Yes, sir.

Mr. WILLIAMS. We will then continue with this testimony.

Off the record.

(Discussion off the record.)

Mr. WILLIAMS. We will have to adjourn at this time until tomorrow, at which time we will hear our regularly scheduled list of witnesses, with the understanding that we may have you back at a later date.

Thank you very much.

(Thereupon, at 11:50 a. m., the subcommittee was adjourned for the day, to reconvene at 10 a. m., Thursday, May 15, 1958.)

NATIONAL SCIENCE FOUNDATION

THURSDAY, MAY 15, 1958

HOUSE OF REPRESENTATIVES,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
SUBCOMMITTEE ON HEALTH AND SCIENCE,
Washington, D. C.

The subcommittee met at 10 a. m., pursuant to recess, in room 1334, New House Office Building, Washington, D. C., Hon. J. Carlton Loser presiding.

Present: Representatives Loser, Dingell, Bush, and Neal.

Mr. LOSER. The Subcommittee on Health and Science will come to order.

We are continuing the hearings on bills to amend the National Science Foundation Act. We are very happy to have with us this morning our colleague, Mr. Holland, of Pennsylvania, who has introduced H. R. 2450.

We will be very glad to hear from the Congressman from Pennsylvania.

STATEMENT OF HON. ELMER J. HOLLAND, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF PENNSYLVANIA

Mr. HOLLAND. My name is Elmer J. Holland, representing the 30th District of Pennsylvania.

Mr. Chairman and members of the committee, on May 14, 1956, before the launching of sputnik, in a speech I delivered before the House of Representatives I said as follows:

> The Western World is in a new grave kind of danger; the West has many times been threatened by military and political domination from the East. But never before has it faced the loss of its leadership in science and technology.

Today that leadership is in greater jeopardy. In fact, it will certainly be lost unless we find ways to meet the new and dangerous challenge coming from Russia.

Today's struggle is no mere military struggle limited to the fields of Europe or Asia Minor. This is a military, political, economic, and technological race between the two giants of the entire world—United States and Russia.

The key to that race is supremacy in scientific and technological manpower. I quoted from Gen. David Sarnoff, chairman of the board of the Radio Corporation of America, when he put it this way:

> American security and industrial strength—two goals which are completely intermeshed—are today dependent upon our success in overcoming the present shortages and insuring an expanded reservoir of scientists, trained engineers and technicians.

This hardly needs to be proved—it is so self-evident. There is no substitute for brains and practical skills in a technical age like ours.

Automation, it is true, is advancing with giant steps, but every step, if it is not to turn into a stumble, demands additional contingents of qualified personnel.

These words were uttered when I introduced H. R. 11200, in the 2d session of the 84th Congress. In the 85th Congress, I again introduced the same bill which became H. R. 2450.

Both of these bills put into legislation the answers I had received from a questionnaire mailed to 149 deans of engineering schools in the United States. Many of the deans answered with 2- and 3-page letters going into detail, citing what they thought should be done to bring the United States back to the leadership that it always held in science and technology.

Their answers were:

1. We are wasting our precious manpower in failing to enable many bright high-school students to attend college. According to Government reports only 53 percent of students with an I. Q. of over 120 attend college, and only 40 percent of them are able to graduate. It is safe to assume that the great proportion of these intelligent youngsters do not attend college because they cannot afford to. And of those who do enroll, not enough go into engineering and science. Thus, we need to offer this vast, untapped reservoir of talent new incentives —first, to encourage them to go to college and, second, to get them into engineering and then to science.

My survey found that the second big roadblock toward getting enough scientists is our shortage of qualified teachers of science at the college level, and of qualified mathematics and science teachers at the high-school level.

Because of the much higher salaries industry can offer, many of the best teachers are lured into industry every year.

The third big roadblock is the lack of money for sufficient research, and the fact that too few go into graduate work and become scientists.

Today's crop of graduate engineers are forced into industry upon graduation in order to earn enough money to repay the investment made in obtaining a bachelor's degree in engineering.

All deans were agreed that a great number of the graduates have full intentions of returning to do graduate work, but they marry, have families to support, and cannot afford to return to school and become a doctor of science.

All of these problems were carefully discussed with a number of deans of engineering in trying to find a solution to the problem. The result is H. R. 2450, now before this committee. In broad terms, H. R. 2450 accomplishes the following:

First, it will meet our estimated future deficit of 13,000 new engineers a year. Thirty scholarships will be offered to outstanding residents in each congressional district in the continental United States and in the territories. This part of the program will become a reality in 4 years, the time it takes to turn out the first class of engineers.

Second, it will help meet our great shortage of secondary-school teachers. It will offer outstanding engineering graduates the economic and professional incentives to devote a 3-year period to secondary-school teaching immediately after graduation.

The professional incentive would be the promise of a 3-year graduate fellowship leading to an advanced degree in engineering.

The economic incentive—to be applied both during the 3-year teaching period and the 3-year graduate fellowship—would be a Government grant sufficient to keep the grantee's income up to that of young engineers in industry.

The number of graduates who would enter this 6-year program is, of course, impossible to predict, but it is reasonable to assume that 60 percent, or nearly 8,000 qualified engineers will be available from each year's class to enter the 3-year secondary-school teaching stint.

After the program attains its height, it will furnish approximately 24,000 high-school science and mathematics teachers the Nation would otherwise be without.

Third, the program will be of immediate benefit to engineering schools and engineering teachers. In order to help the engineering schools hold their faculties, engineering teachers at schools participating in the program will receive supplemental salary grants raising their incomes to the level paid industrial engineers with equal qualifications.

Teachers will then be able to afford to continue their chosen profession, and engineering colleges will no longer have to worry about raids on their faculties.

These benefits will accrue to engineering schools and faculties as soon as the program starts.

Fourth, and perhaps most important in the long run, the program will eventually provide a steady, increased supply of engineers with advanced degrees for both industry and teaching. The salary supplements will apply to these teachers, as well.

I shall not take the time to spell out all the details of this bill, but I would like to mention some other features.

This bill is in effect an amendment to the National Science Foundation Act of 1950 and administration of its program will be in the hands of the Foundation's Director, subject—as all the Foundation's activities are—to the decisions of the National Science Board.

But I should like to emphasize in that connection that a section of the bill specifically forbids any Federal direction, supervision, or control over the administration, personnel, or curriculum of any educational institution.

This is not a bill to control the teaching of engineering in America. It is purely and simply an incentive bill, to encourage America's great engineering schools toward greater realization of their own goals, according to standards and policies which they themselves set out.

Let us take a student from his first examination to his graduate degree, and note how carefully all control over him or the schools he attends or at which he teaches is avoided.

The Foundation will hold exams in each congressional district early in each year, beginning in 1958, for entrance into college the following fall. Outstanding second-school seniors in each district will take the exams, and the top 30 will be chosen. They will receive scholarships to the schools they choose, but only on the basis that the school accepts the scholarship plan and the applicants who apply.

Thus, there is no pressure on student or school. Schools are free to accept or reject applicants on the same basis they do now, insofar as this bill is concerned.

In addition to exemption from tuition fees, each student will receive a living allowance of $100 a month during the school year.

The school itself will receive not just the tuition fees for each student it accepts under this program, but the actual cost of training him. This provision should encourage schools to enlarge their facilities for training engineers and scientists. But they need not do so, if they choose not to.

If a student does satisfactory work, his scholarship will be continued until he receives his bachelor's degree.

Following his graduation, the student may apply for a graduate fellowship. Under this 6-year program, he is granted 3 years of schooling toward an advanced degree, provided he first spend 3 years teaching at a secondary school.

During the entire 6-year period, he will receive Government grants sufficient to maintain his income at a level equal to that afforded by private industry.

Again, there is no compulsion about the school at which the graduate fellow must teach, or on any school to accept him.

But he need not apply for this graduate work. He is free to go into industry or out of engineering altogether. If he is held, it is purely by the incentives. I believe the incentives will hold him.

Again, he is free to go to any school that will accept him, without pressure on either party. All the student must do is keep up his grades, as he must do anyway. All the school must do is maintain its scholastic standing.

In a discussion of costs, it is essential to recognize that money appropriated for this bill will go to develop our most precious resources, manpower. It will be money spent to meet an imperative need. Nothing is too costly if it is essential.

For example, look at the billions we are spending on our military establishments, our foreign-aid program, our farm program, and on other measures necessary to national welfare and security. In comparison, this program is a modest one.

The cost of the undergraduate phase of the program is estimated as follows:

Three thousand dollars a year per student for 13,000 students, or about $40 million for each year's class. The teacher salary supplements are estimated at an additional $23 million. Thus, the cost of the undergraduate phase would be $63 million in the first year, rising to $183 million for the fourth and succeeding years.

Until it is known how many graduate students will enter the advanced fellowship program that cost cannot be estimated, but it is not expected that it will exceed by much the cost of the undergraduate program.

It is my opinion that this program will pay for itself, not in money flowing back into the Treasury, but in increased know-how for the Nation. The fruit of that increased knowhow will be, not only improved national defense and technological superiority, though on that basis alone the expenditure is not only advisable, but essential.

But this program will also help win the war against want, the cause of all wars. It will help bring about more scientific miracles that banish disease and make life easier and more enjoyable.

That has been the payoff of American technological skill, not only for America, but the whole world—a better life, control over disease, and progress toward abundance for all.

If we act promptly to clear this roadblock, that American payoff to the world can continue. If we fail to act, we are likely to lose the big race with Russia, and with it our chance to do anything for anyone, including ourselves.

The launching of a sputnik by the United States did not regain our prestige.

We still have a long road to travel; a crash program will only be temporary.

Our future lies in how we handle the scientific problems. On that, I think all of us agree.

The Holland bill does not encroach on any local State board of public instruction.

In this great creative world we are now in, the scientists of tomorrow shall decide the fate of the world.

Mr. LOSER. Mr. Holland, I want to thank you for your very comprehensive statement in explanation of your bill.

Mr. Dingell, have you any questions?

Mr. DINGELL. Thank you, Mr. Chairman.

I would like to join with the chairman in conveying to you, Mr. Holland, my thanks and my compliments on a very fine and very thorough presentation.

Mr. HOLLAND. Thank you.

Mr. LOSER. Mr. Bush?

Mr. BUSH. I want to welcome our colleague from Pennsylvania in appearing before the committee. I think he has made a very fine statement here in behalf of this program.

I join with my chairman in his remarks.

Mr. HOLLAND. Thank you, Mr. Bush.

Mr. LOSER. Dr. Neal?

Mr. NEAL. I think Mr. Holland has made a most appealing argument for his bill. It approaches a subject, of course, which is very, very acute. I would like to join with other members of the committee in my appreciation of the way in which you have presented this subject and to say that the presentation itself has been very illuminating and very informative.

Mr. HOLLAND. Thank you.

Mr. Chairman, if you wish at any time, I have in my office the correspondence I have had with all the deans of engineering and I shall be very glad to turn it over to you when the time comes to discuss this bill in the committee in executive session.

I have a listing of colleges by States containing statements of the deans of engineering schools presenting the problems they must meet.

Mr. LOSER. I will say to my colleague that I have a number of communications from universities and schools over the country, dealing with H. R. 2450, and without objection, they will be made a part of the record.

(The documents referred to follow:)

UNIVERSITY OF WASHINGTON,
COLLEGE OF ENGINEERING,
Seattle, May 8, 1958.

CLERK OF COMMITTEE,
Health and Science Subcommittee,
House Commerce Committee,
House Office Building, Washington, D. C.

DEAR SIR: I have recently had some correspondence with Congressman Elmer J. Holland about the bills to amend the National Science Foundation Act which are currently under consideration by your committee. He has requested me to send you the enclosed five copies of a paper Government Aid to Scientific and Technical Education, which I recently presented before a group of engineers in Spokane, Wash. The last three pages of this paper particularly refer to the inadequacy of the present program of the National Science Foundation in dealing with problems of graduate engineering education and research. However, I believe the members of the committee will be interested in the entire paper.

I would appreciate it very much if this paper could be incorporated in the printed record of the hearings of your committee.

Sincerely yours,

HAROLD E. WESSMAN, *Dean.*

GOVERNMENT AID TO SCIENTIFIC AND TECHNICAL EDUCATION [1]

by Harold E. Wessman, Dean, College of Engineering, University of Washington, Secretary, Engineering College Administrative Council

I am happy to have the opportunity to speak to this group about the role of the Federal Government in the national movement to produce better scientists and engineers in the United States. Six months have now passed since the Russians launched Sputnik I, the first artificial earth satellite to go into orbit. That historic achievement demonstrated to the world that the United States no longer was the leader in all branches of engineering and science. It was a terrible shock to many Americans who cherished the belief that we could do anything better than anyone else in the world.

Every medium of communication in this country soon began to question the quality of our science and our engineering. Serious indictments were leveled at the educational patterns existing in the high schools and the grade schools. Many leaders in Congress joined in the outcry and the result was easy to predict. Immediately after Congress convened, dozens of bills were introduced into the Senate and into the House, differing widely in detail but all having a common goal—to produce better engineers and scientists. However, certain bills soon emerged as party measures.

President Eisenhower and his advisers got together and prepared an administration program. This was incorporated in S. 3163 which was introduced by Senator Smith of New Jersey. A group of Democratic senators also conferred and incorporated their program in S. 3187 introduced by Senator Lister Hill, Alabama, and cosponsored by 26 other senators. This measure has been termed the "National Defense Education Bill" and is the Democratic reply to the administration program. Similar measures were introduced by both parties in the House. Let us compare the major provisions of each bill.

It should be kept in mind that these measures were introduced as a result of the furor about science and engineering. But, and this is important, the administration bill does not specifically mention the word "engineering" at any point in the 37-page document. Although there are references to science and mathematics in the public schools, there is no specific section in this bill designed to meet the major problems existing in higher education in the fields of science and engineering. As it now stands, it reflects the influence of the secondary school groups, represented by the National Education Association, and the influence of the United States Office of Education.

On the other hand, the Democrats' bill is definitely described as one "to strengthen the national defense, advance the cause of peace, and assure the intellectual preeminence of the United States, especially in sicence and technology

[1] Presented at Spokane on April 17, 1958, to Pacific Northwest Conference, American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc.

through programs designed to stimulate the development and to increase the number of students in science, engineering, mathematics, modern foreign languages, and other disciplines." However, when one studies the implementing titles of this bill, it is questionable whether the program will assure our intellectual preeminence in science and technology.

Under the title II, national defense scholarships will be awarded to 40,000 persons each year for 6 years. The individuals selected will be high school seniors who show exceptional aptitude for higher education. Special consideration will be given to those with superior capacity in science, mathematics, or modern foreign language. Each one will receive $1,000 during each academic year of a 4-year college program. In other words, these are undergraduate college scholarships for outstanding high school students. The element of financial need will not be a factor in the awards.

Obviously, this provides for a lot of scholarships. At the end of 4 years, there will be 160,000 in force and the annual outlay at that time will total $160 million. How many scholarships will each State get? Each State will be allotted that number which bears the same ratio to the total number of scholarships each year (40,000) as the population of the State between the ages of 18 and 21 bears to the total population of all the States in the country between such ages.

In addition, 20,000 scholarships will be awarded to persons already enrolled in undergraduate courses in college. The number to be awarded to each State is determined by the ratio of the number of undergraduates in institutions of higher learning in each State to the total number of students enrolled on a full-time basis as undergraduates in colleges throughout the country.

Governing rules for the selection of individuals within a State are to be formulated by State commissions established by State boards of education. They shall be broadly representative of scientific, educational, and public interests in the State.

At the end of 10 years, the total outlay for undergraduate scholarships, if the Democrats' bill is enacted into law, will be about $1 billion. The administration bill is somewhat more modest in its program of undergraduate scholarships. It provides for 10,000 undergraduate scholarships each year for 4 years, amounting to $750 each approximately. The program would run for 7 years. The total outlay would be of the order of $120 million. Preference would go to high-school seniors with good preparation in or high aptitude for mathematics or science. The distribution to the States would be on the basis of their relative numbers of graduates from public or other nonprofit secondary schools for the most recent single year for which such data is available.

Title VII of the Democrats' bill establishes a program of graduate fellowships: 1,000 are to be awarded the first year and 1,500 during each of the 5 succeeding years. The fellowship amounts to $2,000 for the first academic year, $2,200 for the second year, and $2,400 for the third year, plus an additional amount of $400 a year for each dependent. In addition, each recipient will be paid an amount not to exceed $1,000 a year to reimburse the institution for tuition fees and other costs. The fellowships shall be for periods of study not exceeding 3 academic years and the primary purpose of these fellowships is to encourage outstanding young individuals to obtain doctors' degrees and then enter college or university teaching. In other words, the fellowships are to be awarded only to those who plan to enter the teaching professions in such fields as may be determined by a National Advisory Council on Science and Education to be in the national interest.

No particular field is designated in title VII authorizing graduate fellowships. There is no reference in this section to engineering and science. This omission is causing deep concern among engineering educators. We believe that the best way to improve the quality of engineering in this country is to encourage more of our best seniors in colleges to continue in graduate study for master's degrees and doctor's degrees. Title VII will not accomplish this purpose because the scholarships will cover the whole field of education and the number awarded to engineering students will be altogether too small to be of any significant help. It should be noted that the Commissioner of Education in the United States Office of Education will award these fellowships in accordance with a pattern to be developed by a National Advisory Council on Science and Education. No rules for distributing these fellowships to the States or to institutions of higher learning are prescribed in the bill.

The administration bill also provides for graduate fellowships, but no numbers or amounts are indicated. The Commissioner of Education is given the authority to determine numbers and amounts. However, grants shall be made under this bill directly to the institutions of higher education and the fellowships will be

awarded by each institution under rules established by the Commissioner. Preference will be given individuals who are interested in teaching. Fellowships may be granted for a period not exceeding 3 academic years and only to those who are working for doctor's degrees. This graduate fellowship program is outlined in title IV of the administration bill. There is no specific reference in any way to engineering, science, or mathematics in this title. Consequently, this bill, similar to the Democratic bill, fails to meet the need for a great increase in numbers and amounts of graduate fellowships in engineering.

There are other titles in the Democratic bill, S. 3187, which provides for student loan programs, science teaching facilities in colleges and high schools on a 50 percent matching basis, additional training for high-school science teachers, and guidance and counseling programs. These will not be discussed here. You should know, however, that the total cost of the Democrats' program will be about $2½ billion over a 10-year period.

The administration bill, S. 3163, also authorizes programs of guidance and programs designed to strengthen the teaching of high-school mathematics, science, and foreign language. It does not spell out the money items in the same detail as does the Democrats' bill, but it will also be a very costly program.

Many of my friends in engineering education join with me in believing that neither one of these measures will accomplish much to strengthen the quality of science and engineering in this country because neither bill provides enough aid for graduate fellowships and graduate research programs in science and engineering.

It is a recognized fact that graduate study in college with its accompanying research training is the best way to develop fully the abilities of our best engineering students. But we cannot induce enough of these young men to enroll in graduate study because industry comes after them immediately after they get bachelor's degrees and offers them salaries of $6,000 to $7,000 a year.

Place yourself in the shoes of the bright young senior engineer. He may want to enroll in graduate study, but he has an offer from industry of $6,000 a year. He learns that a graduate fellowship or a teaching assistantship will give him $1,800 a year, if he can get one. The chances are that he is married and needs money. Is it any wonder that he accepts the industry offer?

In 1957, 5,200 master's degrees were awarded in engineering fields; 600 doctor's degrees were awarded. The number of master's degrees should be doubled. The number of doctor's degrees should be quadrupled.

If Congress wishes to raise the quality of engineering in this country, then it must place the emphasis on graduate aid programs rather than on undergraduate fellowships. Numbers and amounts of fellowships for first-year graduate study in engineering must be increased substantially. There should be additional fellowships for doctor's candidates, but the first year award to master's candidates should not be restricted to those who continue for the doctorate. If we can induce a much larger number of our best seniors to enroll in graduate study for the master's program, then we will get a much greater percentage of that group to continue for the doctor's degree.

Frankly, S. 3187 and the administration bill, S. 3163, do not meet this situation. There should be at least 2,000 scholarships for engineering alone, with annual stipends of $4,000 (1,000 of this should go to the university to cover tuition and incidental costs). This program would cost $8 million annually, a relatively small amount when compared to the total cost of the measures proposed in S. 3187. Recipients of these scholarships should be required to participate either as research assistants or teaching assistants in the engineering schools in which they are enrolled.

We have been told that the National Science Foundation will provide for fellowships in engineering and science and for research allocations in these areas. Unfortunately, the program of the National Science Foundation as planned under the increased budget recommended by the President also fails to meet the situation in engineering education. The National Science Foundation does not contemplate a substantial increase in support for first year graduate study programs in engineering, or even for doctorate programs.

This current year, the National Science Foundation awarded 756 predoctoral graduate fellowships in the sciences and in engineering: 178 of these were awarded in physics; 158 were awarded in chemistry; and 92 were granted in mathematics. Engineering received the pitifully small number of 93. The others were distributed to other sciences, such as zoology, geology, biochemistry, etc. Think of it! Ninety-three National Science Foundation scholarships to engineering students next year. We expect more than 30,000 seniors to gradu-

ate this year and we want 8,000 of them to continue into graduate study. The entire number, 756 awarded by NSF, is not enough for engineering alone.

The engineering schools in America have always had difficulty in securing proper recognition from the scientists who administer the National Science Foundation. These individuals make a definite distinction between engineering and science, whereas many legislators use the word "scientist" to include both engineers and scientists. Physics, chemistry, mathematics, and the other sciences have always been given priority treatment by the National Science Foundation. Engineering has been given secondary treatment. The language of the law establishing the National Science Foundation has been such as to foster this pattern. Unless the work "engineering" is written specifically into the law parallel with science, and, unless engineering education and research are recognized by the appointment of engineers to the advisory panels and administrative boards, this pattern of secondary treatment is bound to persist.

Basic research to the physicist or chemist means one thing. Basic research to the engineer may mean something quite different. Physicists and chemists have a tendency to "look down their noses" at engineering research. They classify it as developmental work. Hence, engineering research projects and engineering fellowships are consequently relegated into the background by those individuals whose academic experience has been in the basic sciences.

We engineers believe that it is vitally important that the sciences and mathematics be given increased support to raise their level of achievement, but we earnestly hope that engineering will not be overlooked. Those who administer fellowship programs must remember that able young men with bachelor's degrees in engineering can be used immediately by industry and are open to large salary offers, whereas the able young men with bachelor's degrees in mathematics, chemistry, or physics know that they have to go on into graduate study for advanced degrees in order to get anywhere. The competitive situation is entirely different for the bright young engineer as contrasted with the bright young physicist. That is why a big increase in fellowships is needed to encourage our brililant young engineering students to pursue graduate study. Moreover, a big increase in support for engineering research is urgently needed.

These two needs will never be met by the National Science Foundation as presently constituted. Not a single engineer holds an administrative position in the division handling fellowships. There is an engineer in the division supervising research grants, but he reports to a physicist who has for years treated engineers like "second-class" citizens. The Director, the Associate Director, and the Assistant Director are also physicists.

What is the remedy? Either the National Science Foundation Act must be amended to establish engineering on a par with science throughout the entire administrative framework beginning with the top level, or, on the other hand, Congress should establish a separate National Engineering Foundation similar in scope to the National Science Foundation.

In conclusion may I note again that approximately 32,000 young men will receive bachelor's degrees in engineering this year. How can we get the top one-quarter, or 8,000, to continue now into full-time graduate study for the master's degree? Then, a year hence, how can we get one-fourth of this master's group, or 2,000, to go on for the doctor's degree? When we achieve these figures for engineering graduates as a continuing goal, then we will see a rise in the quality of engineering in this country that will pay untold dividends in future national security and economic strength.

TULANE UNIVERSITY,
SCHOOL OF ENGINEERING,
New Orleans, April 30, 1958.

COMMITTEE CLERK,
Subcommitte on Health and Science, House Committee on Interstate and Foreign Commerce, House of Representatives, Washington, D. C.

DEAR SIR: I regret that I shall not be able to testify at the hearing on H. R. 2450, May 13–16, 1958. I would like to submit a statement for the record of the hearing in lieu of a personal appearance.

There is no doubt but that the state of engineering education in the United States at this time is such that it shall not be able to meet its responsibilities adequately without additional support. I favor strongly any action which could be taken to amend the National Science Foundation Act to make available support to engineering education in every possible way.

I have served as a member of the Education and Accreditation Committee of the Engineers Council for Professional Development for four and a half years. During this time it has been my responsibility to personally head teams of inspectors for engineering curriculums at many institutions in this country, particularly those in the southeastern region of which I am chairman. I had also had the opportunity of sitting on the committee each year and listening to the discussions of conditions in engineering schools throughout the United States and its Territories. Accordingly, I speak from actual knowledge when I say that the majority of the engineering schools in the country are attempting to meet their educational responsibilities with inadequate financial resources.

It is my opinion that the situation with regard to engineering education in this country is critical at this time and that swift and substantial action must be taken to meet it.

Sincerely,

LEE H. JOHNSON, *Dean.*

COLORADO SCHOOL OF MINES,
A COLLEGE OF MINERAL ENGINEERING,
Golden, Colo., May 6, 1958.

CLERK OF THE COMMITTEE,
New House Office Building,
Washington, D. C.

DEAR SIR: In a letter under date of April 16, 1958, Representative Elmer J. Holland advised us to prepare in lieu of personal appearance a statement for the printed record of the hearings scheduled for Tuesday, May 13, through Friday, May 16, pertaining to H. R. 2450 and H. R. 4218.

In my opinion, it is desirable to amend the National Science Foundation Act as suggested, but I would urge that the words "science" and "engineering" be specifically defined, and the definition should include "earth science" and "engineering science."

The terms "science" and "engineering," are defined differently according to the persons giving the definition. If earth science and engineering science are not specifically mentioned, these two important areas probably would be disqualified under the proposed amendment to the National Science Foundation Act by administrators of the National Science Foundation and especially by persons from the Bureau of the Budget and/or auditors in one or more of the Government departments.

I respectively urge that the terms "earth science" and "engineering science" be repeated several times in the proposed amendments referred to.

Yours truly,

JOHN W. VANDERWILT, *President.*

COLORADO STATE UNIVERSITY,
COLLEGE OF ENGINEERING,
Fort Collins, Colo., May 1, 1958.

CLERK,
Subcommittee on Health and Science,
House Committee on Interstate and Foreign Commerce,
New House Office Building, Washington, D. C.

DEAR SIR: Congressman Elmer J. Holland, of Pennsylvania, has invited me to testify on his bill, H. R. 2450, in connection with the hearings to be held May 13–16. Since I will be unable to attend in person I would like to submit the inclosed prepared statement of my views for the record.

Very sincerely yours,

T. H. EVANS, *Dean.*

STATEMENT RE H. R. 2450, PREPARED BY T. H. EVANS, DEAN OF ENGINEERING, COLORADO STATE UNIVERSITY

I find H. R. 2450 to be in the public interest, and particularly so at this time since the rude awakening to our great need for better training in engineering and science with the launching last October of the Russian satellite. Congressman Holland showed a great deal of foresight, in my opinion, in submitting such a bill considerably ahead of the startling event referred to above.

Of greatest concern to me is his provision under title II, part B, for improving the salary situation in engineering teaching to hold the good men we now

have, and to enable us to attract others into this field. The pressure continues on us to provide fine training for a large crop of undergraduate and more graduate students with, in many cases, inadequate salary attraction for the faculty we need. Should this provision be enacted into the NSF Act, then I would hope that each college of engineering would be permitted to make determination in individual cases of the salary deserved up to the national norm. In other words, I would not want to have to put all associate professors, for instance, up to a national figure unless they equally deserved it. There should still be differences in salary within each grade dependent on relative merit. I imagine this is intended by the bill.

When undergraduate scholarship awards are to be made on a strict merit basis, as in this bill, then I feel the proposal is in the public interest. It is the better students that we need most in our engineering programs, and if they couldn't attend without help I hope they can get it by proving their ability in a national test. Just giving scholarships to all needy students, I don't feel, would solve our needs in engineering and science and, therefore, would not serve best the public interest. We have plenty now that just get by, with and without scholarships.

Since it is from the superior students that go on to graduate work that we will get our new teachers of engineering, I feel the aid proposed in part D of title II is very desirable in the national interest.

I believe that the money proposed by this bill will get at our fundamental needs for improvement, and not merely subsidize errors of the past.

UNIVERSITY OF PITTSBURGH,
SCHOOL OF ENGINEERING,
SCHOOL OF MINES,
May 6, 1958.

Re H. R. 2450 (Holland of Pa.) to amend National Science Foundation Act by providing grants for engineering teachers and scholarships and fellowships for engineering students.

CLERK OF THE COMMITTEE ON EDUCATION AND LABOR,
House Office Building, Washington, D. C.

DEAR SIR: Since it is impossible for me appear in person to testify in support of this bill, I desire to submit the following statement to be included in the printed records of the hearings.

In my opinion, to solve the problem of our shortage of scientists and engineers and to resume our position of world leadership in science, engineering, and technology, legislation is needed which will—

1. Improve student counseling at the junior and senior high school levels to assist in identifying and encouraging capable scientifically inclined students.

2. Provide the needed funds for capable students who cannot afford a college education. Such funds to be provided under a competitive system.

3. Make possible a wage scale for science and mathematics teachers in the secondary schools which would encourage teachers to return to teaching who have reluctantly entered industrial employment seeking higher earnings.

4. Provide, at the college level, engineering teachers with advanced degrees who are acutely needed. We believe an engineering graduate with several years of engineering practice makes the best teacher. Unfortunately, such individuals, consequently, do not have advanced degrees and they are not permitted or capable of earning them and meeting their teaching responsibilities. A means of providing a leave of absence at full salary to earn an advanced degree would improve our teaching staff and attract many potentially outstanding persons into the field of college engineering and science teaching.

Adequate salaries at a competitive level with those offered in industry would also enable us to retain our present good teachers and possibly encourage some who have left to return to the field of teaching.

5. Provide adequate funds for buildings and facilities for engineering, science, and related departments.

6. To provide scholarship grants of sufficient magnitude which will pay to the institution the actual cost of providing an education rather than just the tuition charges.

Very truly yours,

G. R. FITTERER,
Dean, Schools of Engineering and Mines.

30225—58——9

Mr. LOSER. Thank you very much, Mr. Holland.

Mr. HOLLAND. Thank you.

Mr. LOSER. Our next witness will be Dr. Detlev Bronk, Chairman, Science Board, National Science Foundation.

STATEMENT OF DR. DETLEV BRONK, CHAIRMAN, SCIENCE BOARD, NATIONAL SCIENCE FOUNDATION, WASHINGTON, D. C.

Mr. LOSER. I believe, Doctor, you are also President of the National Academy of Sciences. We are very happy to have you appear this morning and have the benefit of your testimony with reference to these bills amending the National Science Foundation Act. You may proceed.

Mr. BRONK. Mr. Chairman, it is a great pleasure to appear before you. I hope that I may give my testimony largely in the form of answering any questions in order to conserve your time. You have already heard prepared statements from my colleagues regarding these various proposals. The one that I think is specially significant in the proposed modification of the National Science Foundation Act relate to the possibility of delegating more authority to the Director of the Foundation or to the Executive Committee.

In these days, when science is developing so rapidly and so many important issues are arising, it is highly desirable that the Foundation be enabled to act more rapidly and thus more effectively. This provision for delegation of authority from the Board to the Director or to the Executive Committee is, I think, extremely important.

Also, the provision which would enable us to carry on scientific activities on an international basis in other countries in furtherance of our national interest, is highly desirable.

Science has a wide scope as regards its implications, inasmuch as science depends upon the contributions of scientists in our sister democracies, I have found on many occasions that it would be highly desirable if we were able to utilize more generally and more effectively the talents of our colleagues in other countries of the free world in support of our national interest.

These are the two primary concerns I have, sir. I will be very glad to answer any questions you may ask.

Mr. LOSER. Doctor, do you have a prepared statement?

Mr. BRONK. No, I do not, sir. I do not wish to use your time listening to a long written statement unless you have questions.

Mr. LOSER. We are certainly happy to have you here this morning and have the benefit of anything you would like to say with reference to the pending bills, if you have examined them.

Mr. BRONK. I have, naturally, been very much interested in them. As I say, these proposed amendments to the National Science Foundation Act, of which I have just spoken, are important, especially with regard to these two provisions I have just referred to. The other bill which is of special concern to me is that which provides a $200 million fund which could be drawn upon, one which I think is very important.

Having had to operate as president of Johns Hopkins University and the Rockefeller Institute, I should find it difficult to operate if I did not have a contingent fund to which I could go.

I think my Board of Trustees have adequate control inasmuch as I report at each Board meeting as to what I have done with the money I have drawn from the contingent fund. Had I violated their confidence and trust I am sure I would have heard of their disapproval. I think, therefore, if there be such a fund, as has been proposed, to be used under the discretion of the National Science Foundation in cases of important developments which must be dealt with promptly, this would be of very great value to our Nation. I think, for instance, of the recognized importanct of our doing more in the field of space research, following the 4th of October when the Russians put their first satellite in orbit. But before we could secure the necessary funds, which were generously provided by Congress, some 4 months had to elapse. If we had been able to go to a fund and promptly draw upon it, we could have gone forward more rapidly.

Mr. LOSER. You have indicated, I believe, Doctor, that you look with favor upon the Dawson bill which provides for a $200 million reserve fund.

Mr. BRONK. I do, sir.

Mr. LOSER. Have you examined the Price-Van Zandt bills which provide for special scholarships to students who pass examinations in mathematics?

Mr. BRONK. I have prayerfully considered these various proposals and I do not yet have a firm conviction as to how far we should go with regard to scholarships for scientists only because of the fact that we need in this country so many people versed in many different activities. I view with concern the danger that we might overemphasize the position of science relative to other fields of actvity if we give too much support for those who are proposing to engage in study in the sciences relative to other areas of human learning.

I feel that we badly need more able lawyers, clergymen, journalists, economists, and those in many other walks of life who contribute to our national welfare. If we emphasize science too much by way of subsidization of students in the early years of their development in one area of human activity relative to another, I am concerned lest we unbalance our national culture and the whole general character of our civilization.

As I say, I have not firmly formulated my own opinions regarding this, because I feel that support of elementary students by the Federal Government could have far-reaching consequences.

Before I form a final, firm opinion, I wish to give it more thought. As I say, I am doing so. If I am permitted to do so, I must say I am doing so prayerfully, because I feel this has very widespread implications which I am not prepared to go into brashly and without careful consideration.

Mr. DINGELL. Doctor, you were referring in your comments at this time to the Van Zandt bill, the Price-Van Zandt bill? Would that be correct?

Mr. BRONK. I do not have the bills here before me.

Mr. DINGELL. Doctor, that is the bill which would provide for $500 scholarships to students who pass a national mathematics test.

Mr. BRONK. Yes, I am familiar with these bills. I cannot bring myself to believe that we should, through the means of the Federal Government, encourage people to do mathematics more than we en-

courage people to write well, to study foreign languages, and to develop competence in other important fields of intellectual activity. Do not misunderstand me. I am all for doing anything that can be done to encourage people to have greater competence in mathematics. But I would deplore lack of emphasis on other fields of basic learning which are also important to our national welfare.

Mr. DINGELL. I would like to apologize to the chairman for having interrupted.

Mr. LOSER. That is all right.

Mr. DINGELL. Could you give us specific examples of how a reserve fund of the type provided in the Dawson bill, the $200 million reserve fund, would be used by the National Science Foundation? Can you give us specific examples of how such a reserve fund would have helped in the past few years or would help in the future?

Mr. BRONK. In the case of our satellite program there have been various matters which have suddenly arisen which required funds that were quickly available. In the development of our Antarctic program, there have been times when by going through the normal process of budgetary requests we have encountered delays which have impeded the program.

Suppose a new chemical cure were discovered for some disease. Suppose after use we found there were certain harmful side effects, the reason for which we did not understand. It is obvious that if we were to make certain, important tests we could find out what the reason is. Suppose the necessary research to determine the cause were very expensive.

If there were such an emergency fund, it could immedately be used for the research necessary to answer the question and meet the challenge.

Mr. DINGELL. Would you be able to use it for expense of installations, for example as Muroc, and some other installations in the West, high energy installations, and that sort of thing.

Mr. BRONK. If we were considering the development of a new facility of continuing importance, involving continued expenditures, I would think it would not be desirable to use such a fund.

If, on the other hand, some expensive equipment were urgently needed which would not involve continuing expenditure for maintenance, it would be appropriate to use this fund.

Mr. DINGELL. Doctor, would you say that need should be a criterion?

Mr. BRONK. Yes.

Mr. DINGELL. Doctor, let me ask you this question: In granting Federal scholarships, if Federal scholarships on a scientific level were considered, should need be a criterion?

Mr. BRONK. This depends upon what one means by need.

If by need is meant the national need, I would certainly say "Yes." If financial need of the individual is concerned, I believe one would have very great difficulty in devising an adequate means test.

Mr. DINGELL. Do you think the National Science Foundation should have power to award prices or scholarships for outstanding achievements in all fields of learning, not only for students but for teachers as well, and would such a program be of help in providing incentives?

Mr. BRONK. Do you mean, for instance, in history and so forth?

Mr. DINGELL. Cultural sciences, for example.

Mr. BRONK. I think that if the National Science Foundation were made responsible for all fields of learning, it would have to become a very different organization. You would have to have members of the Board with quite different areas of competence. I do not think under the present structure and with its present objectives it would be wise for the Foundation to deal with all fields of learning.

Mr. DINGELL. Let me ask you this question, Doctor:

The other day I had a little amendment that I tried to put on the mutual security bill which was knocked down on a point of order. The amendment was to permit the use of counterpart funds for acquisition of significant foreign works in the cultural and scientific and technical field for the use of these counterpart funds for indexing, translating, compiling, abstracting, and for the acquisition of these same works in the cultural, scientific, and technical fields, and for the deposit of them in American libraries. I so phrased the amendment that it would be accomplished under the direction of the Library of Congress in cooperation with the National Science Foundation and other interested agencies.

Would you want to make a comment on that at this time?

Mr. BRONK. Well, I don't know what the other demands are upon the counterpart funds, but I think your objective is good.

One of the things we badly need now as we always have is to have more information available to us with regard to what is going on in other countries.

Granted there are natural and normal means for dissemination and diffusion of knowledge, through publications of all sorts. Nevertheless, anything that can be done which makes more available information which is lost in the vast volume of other countries' repositories is of benefit to us.

Mr. DINGELL. Is it not a very real problem in evaluating, abstracting, indexing and translating the foreign periodicals? Is that not a very real problem to universities, research centers and libraries in this country?

Mr. BRONK. It is indeed, sir. The National Science Foundation, the National Academy of Sciences, and various organizations and abstracting agencies have, in the past few years, been devoting a great deal of attention to this. They are developing means which will make this information more readily available.

Mr. DINGELL. Would you say it is sufficiently readily available today?

Mr. BRONK. I would not.

Mr. DINGELL. Would you say your programs are adequate at their present state of development?

Mr. BRONK. No. I would say that the diffusion of knowledge is probably never going to be adequately taken care of. It is always a challenge to the human mind; as the body of material becomes greater, the challenge will become more severe.

Mr. DINGELL. But as a matter of fact, the public libraries and universities are lagging far behind in their abstracting and indexing of foreign publications, is that not a fact?

Mr. BRONK. That is true.

Mr. DINGELL. One of our real problems is getting translations, indexes, abstractions and so forth from foreign technical and scientific publications and books, is that right?

Mr. BRONK. That is true.

Mr. DINGELL. My brother told me of an incident where an American scientist worked 6 months on a problem and because of his lack of access to foreign periodicals, discovered that several weeks before he started, an English chemist had already solved a problem to which he was addressing himself, which is the loss of about 6 months on the part of a skilled American scientist.

Mr. BRONK. I have had the same experience your brother has, so I must say "yes."

Mr. DINGELL. This is not my brother's experience. He was merely telling me of somebody else. But this is rather a common experience in American scientific circles. Doctor, you heard our colleague, Mr. Holland, discuss his program.

Would you like to comment on that?

Mr. BRONK. I am afraid, sir, I did not.

Mr. DINGELL. I would like to thank you very much, Doctor, for your fine presentation. It is always a pleasure to hear you.

Mr. BRONK. It is always a pleasure to be here, sir.

Mr. LOSER. Mr. Neal.

Mr. NEAL. Mr. Chairman, I appreciate the broadminded approach that the doctor presents. It has made us realize that it is such a great field of endeavor that it is most likely that if we make inroads as proposed by some of these bills specifically intended for the advantage of certain fields of science, it is quite natural, however, to say other fields of activity could approach the Federal Government for aid in the same manner.

In other words, it seems to me that these bills open up a field and an activity on the part of the Federal Government where there would be no end, if we start this. You would have not only engineering colleges, but you have medical colleges, and colleges of various phases of educational activity.

It would seem to me that with the thought that you presented, the introduction of legislation at this time specifically favoring certain institutions of learning because there is today an apparent shortage, we could probably justify the same objective on the part of other educational institutions to go along the same way.

I don't doubt but that there is a great absence of engineers in this Nation today, and likewise, I think, there is weight to be given to the fact that our whole educational system has been more or less working ineffectively in many respects.

When it comes to the question of giving scholarships on the basis which is proposed by our colleague, Mr. Holland, allocating a certain number of students from each congressional district, the probabilities are that the many congressional districts would not be in a situation to qualify 30 students.

That, I think, does prevail today in the other academies, in the military and in the Naval Academy, in some instances.

Some certain districts do not participate, one, because of the fact that education in lower fields of activity and endeavor has been insufficient to prepare these people even to go before a board and qualify. It would seem to me that instead of attempting to solve the problem of education from the top, as many of these bills do, that we would reach the desired objective in the long run if we directed our efforts toward improving our public school systems and our high

schools to the point where students are required to take some of the basic mathematics and some of the basic studies in order that they might at least graduate on a level of participation which would enable many of them, even on their own, to get into these fields.

I have the feeling that unless a boy or student in high school is given a little opportunity to look into the field of mathematics or physics, he isn't very apt to develop any liking for that particular field of education.

But if all students in high school are uniformly required to take certain branches of study, from that alone there will voluntarily develop many, many capable, enthusiastic and ambitious students that will avail themselves of perhaps any opportunity they can to go to further their education.

I still believe that education in itself is more or less of a voluntary motive on the part of the individual rather than that which can be bought with a little coffee dollar. You have brought out some very satisfactory thoughts here, and I appreciate your efforts.

Mr. BRONK. Thank you, sir.

Mr. LOSER. Doctor, did I understand you to say that in addition to applying all the ability that you had to solve these problems that confront the Nation today, that you are prayerfully considering them also?

Mr. BRONK. I am, sir, because I think that these problems go right down to some of the basic issues which face our Nation with regard to our motives and national objectives.

Mr. LOSER. It is always refreshing to me to hear a man who has reached high places in the world, particularly a man of science, who realizes that in times of stress we certainly must resort to prayer to the Creater of us all for divine guidance in the problems that confront our troubled world.

I deeply appreciate your testimony here. Thank you for coming.

Mr. BRONK. Thank you very much, sir.

Mr. LOSER. The next witness is Mr. Paul H. Robbins, executive director of the National Society of Professional Engineers.

STATEMENT OF PAUL H. ROBBINS, EXECUTIVE DIRECTOR, NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Mr. LOSER. You may proceed, Mr. Robbins.

Mr. ROBBINS. Thank you. Mr. Chairman and members of the subcommittee, my name is Paul H. Robbins. I am executive director of the National Society of Professional Engineers, a nonprofit, membership organization composed of professional engineers in virtually every specialized branch of engineering practice and type of employment. All of the society's 46,000 members are registered under applicable State engineering registration laws, and are affiliated through 46 State societies and approximately 365 local community chapters.

We appreciate this opportunity of presenting our comments and suggestions on the several bills currently before this subcommittee dealing with proposed amendments to the National Science Foundation Act.

The national society is vitally interested in all matters dealing with engineering and scientific education, and accordingly our discussion

will primarily cover the various educational programs contained in these bills.

Since there are major proposed programs common to several of the bills, it is our intention to comment on the specific program, rather than on each bill separately.

However, before we discuss the bills, there are two basic observations regarding education that we would like to present.

The first is in direct line with the testimony of Dr. Bronk and some of the comments made as a result thereof.

First, public apathy toward education in general can be attributed to a large extent to the constant overemphasis on the cost of education, without a proper awareness of the many values and benefits which a highly educated population contributes to our national economy.

Education is the lifeblood of our democratic society. Its absolute necessity should be foremost in our minds, and its cost should be recognized as an essential investment in the Nation's future.

In this connection, it is our belief that Federal departments and agencies presently involved with education should embark upon an extensive program of emphasis on the value of education, enlisting the support and cooperation of industry as well as the general public in this activity.

No other investment can return the dividends that an efficient, stimulating educational system can provide.

Secondly, we believe that the local community has the primary responsibility to provide educational programs and opportunities for persons of that area. However, we do feel that the Federal Government can by certain actions assist and enable the local community to more effectively discharge its educational obligations. In this connection we are convinced that it is infinitely more effective for Congress to enact legislation that will aid the local community in its educational activities, rather than subsidize it.

Now we would like to direct our comments to the specific programs currently before this subcommittee for consideration and study.

UNDERGRADUATE SCHOLARSHIPS

Several of the bills contain provisions calling for the establishment of undergraduate scholarship programs in the fields of engineering and science.

The number of scholarships suggested is substantial—approximately 13,000 per year. The national society believes that such an extensive scholarship financing program for undergraduate students would place the emphasis on the need for more students, at a time when engineering and scientific enrollments in United States colleges and universities are at an all-time high and increasing. Engineering educators are today faced with the problem of providing the students they have with an adequate engineering education.

Additional number of students, over and above the increased influx of students expected as a result of the high birthrate of the 1940's, will place a tremendous burden on existing facilities and faculties within the next 2 years.

Indeed, the President's Committee on Education Beyond the High School in specifically not recommending the development of a large-scale program of Federal scholarships stated that—

> it could accentuate the danger that enrollments will rise faster than the faculties and facilities needed to care for them, and it would not represent the most effective means by which such Federal assistance as may be needed could be used to aid both students and institutions * * *

The national society is in complete accord with the President's Committee on this important point. We believe that the primary concern of the Federal Government should be with improving the quality of our college students, not their quantity.

Engineering enrollment, for example, is higher today than at any other time in our history. Present enrollments justify the prediction that there will be 150,000 engineers graduated during the period 1956–60 as compared to 95,800 engineers graduated in the 4-year period ending in 1956. In addition, our expanding programs of education in technical institutes will further increase the total of engineering and supporting technical services.

Thus, it is questionable that this Nation can adequately train and absorb, under existing conditions, increased numbers of engineering students pursuing their education only to the bachelor's degree. For these reasons, the national society is opposed to any Federal undergraduate scholarship program in engineering or science.

Several months ago there began to appear a large number of articles and statements regarding the so-called shortage of engineering personnel, which in many cases called for large-scale crash programs to train thousands upon thousands of additional engineers. At the same time there arose many voices which said that we had and were continuously training an adequate number of engineers.

Because this controversy so vitally concerned our national defense and welfare and the engineering profession itself, the national society gave serious and extensive study to this situation and developed a comprehensive statement regarding the shortage of engineering and scientific personnel in which several important observations were made.

Copies of our shortage statement were attached too as appendixes to our presentations before the Senate and House Education Committees earlier this year on Federal aid to education and we attach a copy of our statement to this testimony for your further information.

(The document referred to follows:)

THE ENGINEERING "SHORTAGE"

Statement by the National Society of Professional Engineers, October 17, 1957

Within recent weeks, related developments have provided fresh evidence for those who contend that there is a severe shortage of engineering and scientific personnel and, at the same time, for those who maintain that there is not a shortage. This contradictory situation has existed since 1949 when one of the largest engineering graduating classes in history led to predictions of an oversupply—followed a year later by the Korean war, the increase in defense spending, and the subsequent high demand for engineering and scientific personnel.

Since then, many leaders in public life and industry have expressed a fear that the output of trained engineering talent has been lacking in numbers to the ex-

tent that the Nation's security is in jeopardy, and have called for various forms of "crash" programs to produce more engineers. Others have contended during this period that the shortage was synthetic, or highly exaggerated.

Recently, defense budget cuts caused the layoff of a number of aircraft employees, including some 1,000 engineers. This resulted in extensive publicity to the effect that the shortage was over and that more engineers would be laid off as further cuts were made in defense spending. Now, the launching of the Russian earth satellite has resulted in even more extensive statements and publicity that the United States is trailing Russia in scientific achievement because we have not produced enough engineers and scientists compared to the U. S. S. R. New demands are being voiced for "crash" programs to train larger numbers of engineers and scientists. Some leading members of Congress have stated that they will move for extensive Federal scholarship programs when the legislators resume their work next January. In the face of this on-again, off-again situation, the engineering and scientific professions and the general public are understandably confused and uncertain.

The validity of each point of view regarding the supply of engineers depends on interpretation and analysis of data which have been published in great detail and variety. Despite this wealth of information, however, both points of view probably can be defended if the definition of two terms—"engineer" and "shortage"—are made by the respective groups.

The National Society of Professional Engineers has observed and studied the various statements, reports, and analyses during this period. We recognize an obligation to the Nation's economy, the engineering profession and to the young people who may be considering the choice of an engineering career, to lend assistance in the clarification of these conflicting viewpoints, and to the extent possible to assist in the selection of the best alternatives in the future.

It is most important that the Nation not rush into hastily improvised actions having to do with the education of engineers which would only aggravate a complicated and difficult condition that cannot be solved by spur-of-the-moment solutions.

Based on close observation of the engineering profession's growth and intimate experience in professional engineering activities, NSPE believes that the following factors are sound observations for future guidance:

1. Special action to increase today's supply of engineers is not considered necessary or desirable since engineering enrollments are at an all-time high and are continuing to increase.

2. An artificial stimulation to further increase enrollments in engineering will severely handicap institutions that devote adequate attention to the capable students.

3. Assumption that Russia launched the earth satellite before the United States solely because it had trained more scientific personnel in recent years than this country, we believe is not valid and could lead to unwise and damaging decisions. We believe it would be more logical to assume that the controlling factors were priorities assigned to money and emphasis, rather than a shortage of technical personnel in the United States.

4. Emphasis now more than ever should be placed on quality rather than quantity. Potential engineers should be better grounded in fundamentals when they enter the engineering educational program and should be better informed as to the qualifications essential for an individual to become a successful engineer.

5. In view of the present limitations of facilities and faculties, the substantially increased enrollments in our engineering institutions are causing serious difficulties at the present time. Any program which will substantially add to the present number of students must include means to resolve these limiting factors.

6. It should be emphasized that projects such as the earth satellite, guided missiles, etc., depend on highly advanced technology—a mere increase in numbers of those with first degrees will not provide the type of highly advanced technical knowledge which is necessary. It should also be noted that any program based on present needs will not succeed in solving today's technological problems. A program starting today will not produce a single highly qualified engineer or scientist for at least 6 years.

7. Experience has shown that we have wasted engineering talent by using it at a level below that which it is capable of performing. Improved utilization of engineering talent can do more for an immediate need than any other single program.

Mr. ROBBINS. Although the national society is opposed to any Federal undergraduate scholarship program which would award extensive numbers of scholarships annually, we would support a limited number of engineering and scientific scholarships, with no more than 1,000 per year, to be awarded at the national level as a recognition of scholastic achievement and merit.

Such scholarships could be in the nature of a prize granted to the top students throughout the country who have demonstrated a high level of aptitude for engineering or scientific studies.

It is believed that such an honorary award, coupled with national publicity and recognition, could serve as a powerful incentive to scholastic attainment and would encourage those students with the highest potential to pursue their formal education.

GRADUATE FELLOWSHIPS

The National Society of Professional Engineers strongly endorses and supports all plans which will expand in both number and coverage existing programs for the awarding of graduate fellowships in all fields of endeavor.

This we think is in line with Dr. Bronk's presentation to you a moment ago.

With regard to engineering and science, we believe that graduate study is essential for the development of intellectual capacity to provide this Nation with new ideas and inventions. Our rapid technological advances and the necessity for continued progress demand that our engineers and scientists be trained to the highest degree of competence and ability.

Since only about one-half of the standard 4-year undergraduate program consists of engineering subjects, it can readily be seen that with then only 1 year of graduate study, the engineer can increase his technical competence by approximately 50 percent.

This is a significant indication of the extent by which the total competence of our engineering manpower can be increased by graduate study.

I am sure there have been presented to the committee the statistics on graduate study. As you know, something in the neighborhood of 4,500 engineering graduates each year go on for master's degrees and something like 600 in the past few years go on for doctor's degrees. These are national pictures and present a rather alarming picture with regard to this national graduate study.

In addition to the overall increase in capability resulting from graduate study in science and engineering, those who enter the field of engineering education can be better trained, resulting in consequent improvement in the quality of our collegiate education.

In connection with the field of engineering education it is noted that certain of the bills currently before the subcommittee would attach to the awarding of a graduate fellowship the condition that the recipient devote a period of time to the teaching of engineering courses in secondary schools.

Certainly such a situation is highly desirable, for it is generally well recognized that the most serious crisis facing our educational programs today is the shortage of highly qualified, first-rate teachers at all levels.

In fact, the national society believes that the Federal Government should take all possible steps to contribute to the ability of all educational organizations (primary, secondary, and college) to attract and retain superior men and women in teaching positions.

However, though such an arrangement could go a long way toward a solution of two of the most pressing problems facing the country today, i. e., the need for additional numbers of persons with postgraduate degrees and the need for qualified and responsible teachers, it is suggested that during the initial period of operation this should be considered a pilot project and a limited program might well be initiated.

We have made this suggestion in view of the possibility that many persons might elect not to take advantage of the fellowship program due to the fact that a teaching obligation is imposed.

Rather than set up a full-scale program with a teaching condition attached in the first instance, it is recommended that a trial run be initiated for the purpose of determining the degree of enthusiasm and interest.

AID TO ENGINEERING TEACHERS

As indicated above, the national society strongly favors any Federal action which will assist our educational institutions to obtain and retain adequate numbers of qualified personnel for teaching positions. It has been stated many times before that perhaps the greatest deterrent facing individuals contemplating a teaching career in this is the low salary level currently being offered in comparison to other employed groups in our economy.

The apparently limited opportunities salarywise facing teachers today is perhaps most serious for teachers of engineering, science, and mathematics who have been made well aware of the higher salaries their talents can currently command in industry and other areas of employment.

It is essential, then, that some method be devised for letting these people know just how much their abilities are needed in the teaching field. In this connection, the National Society of Professional Engineers believes that it is more effective for the Congress to enact legislation that will enable a community to discharge its educational responsibilty rather than to enact legislation that will subsidize educational activities in that community.

By this we mean that the local community must be able to raise salaries of teachers in an effort to bring their total income up to a level comparable to salaries received by persons with simliar qualifications in other fields of employment.

There is a great deal of merit in Representative Holland's proposal for the Federal Government to make payments to educational institutions for use as salary supplements to engineering teachers. This proposal recognizes the important role of the teacher in our continued technological advancement, since well-qualified teachers assure the adequate technical preparation of students for their chosen careers and stimulate the ambitions of those students with exceptional ability toward greater achievements.

While we endorse the sound motive of Representative Holland's proposal, the national society cannot support the mechanism devised as a solution to be problem. It is our opinion that educational institutions should be encouraged and enabled to increase the salaries

of their teaching staffs through means other than by direct Federal subsidies.

Otherwise, there could be a gradual shifting over a period of time to a point where the salaries of engineering teachers are paid by the Federal Government.

While there are areas in which the Federal Government can and should act to improve our educational systems, we believe the proper principle should be indirect assistance, rather than direct subsidy.

For example, we believe that the recent Internal Revenue ruling relating to the deductibility of the expenses incurred in increasing professional competence, as applied to the teaching profession, is the proper and to-be-encouraged form of Federal action in this field.

We also present to this subcommittee the important fact that in addition to salary adjustments, it is essential that teaching positions be made worthwhile to capable people both from the standpoint of prestige and professional recognition.

Furthermore, the society urges the establishment of a program by legislative action in line with what industry is presently doing, to provide authority and funds to Government agencies for the temporary summer employment of teachers in positions that would improve their teaching ability and income.

Of direct concern to this subcommittee, the national society also recommends an expansion in the summer institute program of the National Science Foundation for the advanced training of high-school science and mathematics teachers.

AWARDS FOR PROFICIENCY IN MATHEMATICS

The national society believes that the need for science and mathematics in the high schools is not alone for the preparation of people who will enter a college educational program where such training is essential to their progress.

This, again, has been brought out by Dr. Bronk and in some of the comments on his testimony.

It is important that many other people who function in the present economy understand science and mathematics in order to be most successful and productive.

In other words, science and mathematics are part of present day culture and anyone who is not acquainted with this aspect of our civilization is not well grounded in the fundamentals essential to his cultural growth and his economic well-being.

For these reasons, we support in principle the proposals which would provide an award for mathematics proficiency designed to encourage and stimulate student interest along these lines.

However, the national society is of the opinion that the proposed program would prove more beneficial if the number of awards were greatly reduced, and the emphasis placed on excellence of achievement rather than on the passing of a standard mathematics examination.

We believe that a limited number of such awards would greatly enhance their prestige and desirability and at the same time afford proper national recognition to the recipients.

The value of such a program, as an incentive and stimulant, decreases rapidly as it becomes routine and easily attainable. We would, therefore, prefer a limited number of such awards for mathe-

matics and science proficiency, each in the nature of a prize, and each carrying a more substantial stipend.

The National Society of Professional Engineers appreciates this opportunity to appear before you today and to present our comments and recommendations on various proposals to amend the National Science Foundation Act. We desire to cooperate with the subcommittee to the best of our ability and we stand ready to assist further in any way possible.

Mr. LOSER. Mr. Robbins, I am wondering if you are familiar with the Dawson bill. The Dawson bill provides for a $200 million reserve fund.

Mr. ROBBINS. Yes.

Mr. LOSER. Would you care to comment on that?

Mr. ROBBINS. Well, I feel totally inadequate, following Dr. Bronk's comments, who certainly knows far more about this than I do. I would have nothing, I believe, to add to Dr. Bronk's comments. The creation of such a fund would certainly provide to the National Science Foundation moneys which could be allocated for any kind of a program in the areas of scientific or other investigations in the national science interest. The availability of such funds could certainly eliminate some of the time element that may be essential in certain of our basic research which may be of very vital concern, either to the health and welfare of our people or possibly to the defense of our Nation.

Mr. LOSER. Thank you very much, Mr. Robbins, for your very fine statement.

Mr. Dingell?

Mr. DINGELL. I have no questions, Mr. Chairman.

Thank you.

Mr. ROBBINS. Thank you.

Mr. LOSER. I understand Mr. William Hoff, General Counsel for the National Science Foundation is here.

STATEMENT OF WILLIAM J. HOFF, GENERAL COUNSEL, NATIONAL SCIENCE FOUNDATION

Mr. HOFF. Yes, I am here. I didn't realize I was scheduled as a witness.

Mr. LOSER. A member of our staff suggests that you might be able to furnish for the record specific examples of the types of expenditures that would most likely have been made in the last 3 years if a reserve fund as provided in the Dawson bill had been available.

Mr. HOFF. Yes. I am working now on getting a collection of items that look most illustrative of that point and will submit them later.

Mr. LOSER. You will submit that for the record?

Mr. HOFF. Yes.

(The information referred to, when received, will be placed in the committee files.)

Mr. LOSER. Our next witness will be Mr. Merritt A. Williamson, professor of engineering at the Pennsylvania State University.

We are very happy to have you here and to have the benefit of your testimony on these bills.

Mr. WILLIAMSON. Thank you, Mr. Chairman.

STATEMENT OF DR. MERRITT A. WILLIAMSON, DEAN, COLLEGE OF ENGINEERING AND ARCHITECTURE, THE PENNSYLVANIA STATE UNIVERSITY, UNIVERSITY PARK, PA.

Mr. LOSER. You may proceed.

Mr. WILLIAMSON. My name is Merritt A. Williamson. I am dean of College of Engineering and Architecture at the Pennsylvania State University, University Park, Pa.

I have been in my present position since August 1956. Prior to that time I was working in industry and did some evening teaching at the University of Pennsylvania in Philadelphia.

I am appearing here today at the invitation of Congressman Holland who thought that my views on engineering and science education might be helpful.

I am, therefore, representing myself and any views I may express are entirely my own and should be understood in the light of my industrial experience and my service in the Navy, as well as my present concern with educational matters.

I have read a few of the House and Senate bills but have not made any extended study of proposed legislation. I, therefore, shall not refer to specific bills, but will state what I believe to be sound items to include in any legislation that is ultimately enacted.

We hear a great deal of talk about the shortage of engineers and scientists. I would like to state that in my opinion much confusion exists with the use of the term "shortage." I confess that I do not know what this term means.

If by shortage one means a demand, then we do have a shortage of engineers. A glance at the newspapers and magazines will show that there are still advertisements for persons with technical backgrounds. It is difficult to know how many of these advertising companies are seeking the same personnel in anticipation of the same government contract which has yet to be awarded.

A precise determination of demand is difficult to obtain. If, on the other hand, one means by a shortage a need for scientists and engineers, then this becomes even more difficult to determine.

That there is a real need for certain types of engineers in certain critical areas and with certain prescribed experienced background, there can be no doubt.

Such need, such shortage, or such demand cannot be filled by any number of new graduates or by experienced engineers with training in other areas.

In my opinion, one should be extremely careful not to assume that there is a tremendous need for engineers in all areas.

Particularly where large numbers of engineers have been employed, I believe that there has often resulted considerable misplacement of engineering talent and a utilization far below its potential. This situation reflects poor organization and management due to extremely rapid expansion in which large numbers of new technical employees are integrated. It is almost inevitable that this should happen.

When funds become scarcer, all organizations have to examine themselves to insure better utilization of personnel. The shunting of engineers, particularly recent engineering graduates, into areas where

technicians can work has been observed. This may be an indication that the most critical shortage and need is for technicians.

These are people who have had several years of college work directed more toward techniques and manipulations than highly theoretical subjects. The associate degree is usually awarded for this type of educational background. The Pennsylvania State University has one of the larger programs in the United States for training these individuals. None of these have any trouble getting jobs although there are many companies who do not yet understand what technicians can do, and who may still insist that laboratory employees have a bachelor's degree.

In the light of the above discussion of shortage, demand, and need, it seems to me since we cannot produce immediately persons with fine academic backgrounds and years of pertinent experience, that the best we can hope to do in the future is to produce engineers and scientists who are more creative and more productive and of a higher level of competence than we are graduating at present.

In my opinion, we do not need larger numbers of engineers and scientists but we should demand greater creativity and greater productivity from those we do graduate.

The only place where such persons can be obtained in any significant quantity is from our educational system. If they are to be scientific and engineering leaders of the future, their curriculum will have to be in technical areas. Some will start in these areas as undergraduates but others may enter them in graduate school after a liberal arts education. These latter, however, are rather rare.

As dean of one of the largest colleges of engineering in this country, I have not yet been aware of any scarcity of applicants. Some of those whom we admit do not find the curriculums to their liking and many of them transfer or drop out of school. The exactness and rigor of technical curriculums is certainly not appealing to the immature mind.

I feel that there is a very low correlation between a person's predicted success in technology and his high-school average, or his intelligence quotient.

The critical ingredients, in my opinion, beyond their intellectual capacity is their motivation, drive, and desire to become professional men, skilled in the application of science. I do not believe that this can be determined at the time of graduation from high school. The only practical way open is for the process of competition to eliminate the unfit. Persons who do not make the grade in engineering may transfer elsewhere and become high ranking students. I therefore would approach with caution any psychological or other tests administered to high-school graduates offered as a means of identifying those persons who will be successful in engineering.

I would not be a good scientist if I did not recognize the possibility that sometime one test might be developed which would increase the possibility of successful prediction, but I know of no such instrument at the present time.

I have been watching for such a device so that we could identify latent creativity and ingenuity in our entering freshmen so that we could give certain selected persons special courses to develop these abilities.

We in engineering education would, of course, like to have the highest quality students enroll. We would like to see boys and girls with drive and ability come to college even though their families find it

financially impossible to send them. Of those who are mentally equipped to handle an engineering curriculum, we recognize that there are many who have no interest in such matters.

From this same pool of intelligent boys and girls must be drawn our clergymen, physicians, teachers, and business leaders. Rather than increase numbers of undergraduates in engineering, we need a scheme whereby the quality can be enhanced and where competition will not eliminate such large numbers.

I am somewhat alarmed at some of the proposals for extensive Federal scholarships for undergraduates. In my opinion, the student at age 17 or 18 should be disabused of any notion that the world owes him a living and that it is his right, not a privilege, to attend college at public expense.

If such scholarship assistance became widely available, I believe that the attitude of the student and his approach to the problems of technology would not produce the desired result.

I am not in favor of Government scholarships for undergraduates on the grounds that, first, it is at present virtually impossible to identify promising engineernng talent; and second, the outright gift and subsidy of an individual does not, in my opinion, contribute either to the individual's character or to the ultimate strength of our Nation.

I was a scholarship recipient myself, and I know how much financial assistance can mean. I also worked. I feel that universities, not the Government, should administer scholarships to those students whom they know well. Such awards should be based, wherever possible, on demonstrated college performance and then only after demonstrated financial need.

Although I do not believe in Federal scholarships at the undergraduate level, I do believe firmly in having the Government make loans available to those students in institutions of higher education who desire and need them.

Presumably the maximum limit of a loan would cover all college expenses. I believe that the Government could well afford to establish such a revolving fund; could set certain standards for the awarding of such loans; and could set aside the necessary reserves so that in the event a loan recipient died, his obligation could be canceled rather than transferred to some other member of his family. If such loan funds were available, in my opinion there would be absolutely no reason why any qualified and motivated person could not go to college.

The prevalent attitude that handouts should be made by the Government is, as far as I am concerned, a weakening moral influence. The Government could, I believe, arrange to add a line to the income-tax form so that some amount per year could be returned with or without interest, starting at any designated time after graduation. Such money, plus interest, if desired, could then be used again by others. Loans as opposed to gifts would in my opinion bring into our colleges a much more serious, studious group. They would be investing borrowed money in their own future.

I think that this is good.

Thus far, I have talked about undergraduate education. The education and training of the most important and most productive engineers and scientists is the responsibility of the graduate school. This

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is the area where help is greatly needed. It is in this area where Government scholarships and fellowships could, in my opinion, be very effectively used. An excellent appraisal of the individual's undergraduate career is available.

The prognosis for his success becomes increasingly reliable since he is more mature and more stable. At this time of life (when he is 21 or 22 unless he has had his military service), he really needs financial support. Certainly scholarships at this point do not have a weakening effect.

In order to maintain a fellowship or scholarship in any first-rate graduate school in the country, an individual works far harder than at any other period of his life and for far less monetary returns. I would be in favor of some such scholarship or fellowship plan. I would also favor granting loan privileges to graduate students if additional money is needed.

Thus, far, I have discused only the students. Now I would like to speak about the institution and discuss it with respect to both faculty and facilities.

The institution must have all possible help, including financial help, to strengthen engineering education at the graduate level. Society is demanding increasing numbers of people with knowledge beyond that represented by the bachelor's degree.

Graduate work is expensive. Graduate facilities are expensive. A laboratory for a graduate student takes up room equivalent to that used for 4 or 5 undergraduate students.

Provision of these facilities is a source of major expense. Graduate work in engineering and in science is very expensive since expensive equipment must be provided. It would be my recommendation that for every graduate student enrolled in this area, an amount of money be granted to the institution where such graduate student is enrolled. This money could then provide the equipment and facilities required for effective education.

The Government does, at present, help our graduate programs through various Government projects on which both faculty and graduate students work.

Different governmental agencies, however, allow reimbursement at different rates of overhead for their contracted work. This should be made uniform and the Government should pay enough so that the expenses incurred are being fully met.

Some institutions have no way of financing the difference between what is expended on the project and what is recovered. Thus they cannot avail themselves of this help. It is highly desirable, and I would strongly urge, that more projects, particularly those devoted to the area of basic research, be established with our universities. Without doubt, these are the greatest boon to graduate work in our colleges at the present time. More money needs to be available for this sort of spending. Contrary to providing scholarships and fellowships, there is a much more certain return on this money since new knowledge inevitably results.

A share of this is capable of ready utilization in the public interest by the Government or by others. The facilities which these projects provide assist measurably in the thorough preparation of technical men.

The mechanism already exists for this kind of Government help to educational institutions and it could be considerably expanded and more more uniform.

I now wish to speak on facilities. Our colleges and universities are faced with adding physical plant facilities if they are to increase enrollment.

How the Government can help with the matter of new buildings or assist with maintenance, and do it adequately and equitably, I do not know.

I seems to me that perhaps the best way is to make some allocation to those institutions based upon the numbers of students who are receiving Government aid, either by loan or by graduate scholarship or fellowship.

Those institutions contributing most to the education of the financially needy would then have some fund of money earmarked for building expansion or the purchase of additional capital equipment. This would be one way to help the very real problem of replacement and maintenance.

You will note that throughout this presentation the problem of how to decide which institution should receive what Government money has been resolved. This is resolved by the student himself by his choice of college.

This seems the fairest way to remove this from the area of petty politics. Education is too important to have partisanship and regional provincialism interfere. Money for maintenance of physical plant and equipment is vitally needed.

To throw an added burden on the colleges by fostering increased enrollment without making provisions here is to put the college administration in worse financial straits.

I must call attention to the need for increased salaries for our teachers. The salary situation, as you all know, is disgraceful. How effective Federal action to rectify these inequities can be taken raises a number of problems. I should like to offer a solution. I believe that the appropriate recompense for teaching varies from region to region and college to college within each region.

I feel that this is a matter best handled by each individual university administration. The universities and colleges need added funds for this purpose. I believe they can obtain these funds if appropriate legislation is passed in line with the tax credit plan proposed by the American Council of Education described in a leaflet issued by them on February 1, 1955.

By this proposal each institution could raise its tuition by 42 percent without placing any more burden on the parents. Upon enacting this legislation, the institution could raise its tuition and thus obtain the necessary money.

The problem of distribution of Federal subsidy to institutions is thereby solved equitably.

Mr. DINGELL. You discuss the problem there of how the parents would be affected. What about somebody who is putting himself through school on his own, or what about somebody who is, let's say, being put through school by some one who had, let's say for purposes of taxation, no taxable income?

Along the same lines, what about someone who is drawing funds from a scholarship or a fellowship program, which is obviously not a taxable item.

Would you have some comments you would want to make on that?

Mr. WILLIAMSON. Yes, I have thought about that, and I would presuppose this plan on the basis of some loan funds available to these people so that they could continue in school.

Mr. DINGELL. They would not benefit from the Federal tax credit thing which you are discussing?

Mr. WILLIAMSON. No, they would not.

Mr. DINGELL. Thank you, sir.

Mr. WILLIAMSON. At least I know of no scheme whereby they could.

Mr. DINGELL. Thank you.

Mr. WILLIAMSON. I need not expand on this tax proposal as I am sure this is in the record.

This tuition increase would, in my opinion, put our institutions in a position where competent men could be attracted and our present devoted staff members would then be in positions to continue work without sacrifice on their part or on the part of their families.

If the money so provided is more than sufficient to adjust those presently employed, then additional staff could be hired. Such decisions should remain the prerogative of the individual institution.

While I am here, I would like to endorse the statement of the National Society of Professional Engineers which is appended to this statement. I would also like to especially endorse those resolutions of the American Association of Land Grant Colleges and State Universities made at their 71st annual convention in Denver last year, which are also appended to this statement.

Thank you.

(The documents referred to follow:)

APPENDIX A

The following is an excerpt from The Engineering Shortage, a statement by the National Society of Professional Engineers on October 17, 1957:

"Based on close observation of the engineering profession's growth and intimate experience of professional engineering activities, NSPE believes that the following factors are sound observations for future guidance:

(1) "Special action to increase today's supply of engineers is not considered necessary or desirable since engineering enrollments are at an alltime high and are continuing to increase.

(2) "An artificial stimulation to further increase enrollments in engineering will severely handicap institutions that devote adequate attention to the capable students.

(3) "Assumption that Russia launched the earth satellite before the United States solely because it had trained more scientific personnel in recent years than this country, we believe is not valid and could lead to unwise and damaging decisions. We believe it would be more logical to assume that the controlling factors were priorities assigned to money and emphasis, rather than a shortage of technical personnel in the United States.

(4) "Emphasis now more than ever should be placed on quality rather than quantity. Potential engineers should be better grounded in fundamentals when they enter the engineering educational program and should be better informed as to the qualifications essential for an individual to become a successful engineer.

(5) "In view of the present limitations of facilities and faculties, the substantially increased enrollments in our engineering institutions are causing serious difficulties at the present time. Any program which will substantially add to the present number of students must include means to resolve these limiting factors.

(6) "It should be emphasized that projects such as the earth satellite, guided missiles, etc., depend on highly advanced technology—a mere increase in numbers of those with first degrees will not provide the type of highly advanced technical knowledge which is necessary. It should also be noted that any program based on present needs will not succeed in solving today's technological problems. A program starting today will not produce a single highly qualified engineer or scientist for at least 6 years.

(7) "Experience has shown that we have wasted engineering talent by using it at a level below that which it is capable of performing. Improved utilization of engineering talent can do more for an immediate need than any other single program."

APPENDIX B

The following are excerpts from Proposals for National Action To Help Solve the Crisis in Higher Education, resolutions of the American Association of Land-Grant Colleges and State Universities, adopted at the 71st annual convention in November, 1957, at Denver, Colo., pages 8, 9, and 11:

"*Be it further resolved*, That in order to assure scientific and technological leadership, which is a national responsibility, the association urges the President of the United States and the Congress of the United States to take necessary measures and policies as appropriate in each instance, to:

"(1) Encourage and support full-time programs of graduate study in science and engineering leading to the doctoral degree, and provide for the identfication and support of gifted students to pursue such full-time studies.

"(2) Encourage the improvement of the rigor and quality of all stages of the education of engineers and scientists.

"(3) Encourage competent scientists and engineers, through increased support and appropriate policies, to initiate and prosecute thorough, intensive, and extensive studies in the spirit of free inquiry, especially in the critical fields of fundamental scientific research, at an accelerated rate.

"(4) Create conditions under which colleges and universities and other nonprofit scientific organizations can accept Federal support for the work of their scientific personnel without diversion of funds needed for other necessary functions to projects initiated under Federal support.

"(5) Create conditions under which assurance can be given that investigations so undertaken can be pursued to their reasonably logical conclusions without threat of unanticipated termination or other disruptive fiscal influences."

Therefore, be is resolved: "(1) That this association go on record as not favoring at this time a system of Federal scholarships at the undergraduate level representing direct grants to individuals."

Mr. LOSER. Thank you very much, Dr. Williamson.

Your statement has been very thought-provoking and of great interest.

You have attempted to resolve many problems that concern the Congress with reference to Federal aid to education.

Mr. Dingell.

Mr. DINGELL. You discussed the problem of assistance to engineering graduate students as opposed to undergraduate engineering students. I wanted to know whether you had any views as to the kind of engineering graduate students or the kinds of technical or scientific students. Obviously, the program we would consider would be a program which would be aimed at the helping of students whose services would be most valuable to the country. Without this being in any way derogatory toward the architects, I assume that architectural engineering or architecture is a fairly lucrative and also a field of engineering which is not of great or not of most primary importance to defense.

Would I be fair in that statement?

Mr. WILLIAMSON. I am not entirely sure that you would, sir. We distinguish between architects and architectural engineers. There is a tremendous shortage of architectural engineers.

Mr. DINGELL. Let's take the architects. Obviously the architect would not be engaging in basic research of importance to defense. Would that be a fair statement?

Mr. WILLIAMSON. Yes.

Mr. DINGELL. Would it be true, to a lesser degree of, of architectural engineers?

Mr. WILLIAMSON. I would not think this would be entirely true, sir, for this reason: One of our most promising graduates and a person we hope to get on our faculty if we can make it attractive to him, is currently doing his service in the Navy. He is engaged in design work in connection with structures and the effect of atomic warfare on structures, atomic damage. This is an extremely important area.

Mr. DINGELL. My understanding was when an atomic or hydrogen bomb goes, everything is obliterated and no such thing as a structure is left standing. If I am in error on that, I hope you will correct me.

Mr. WILLIAMSON. There has been a great deal of research done in Europe on the building of structures which will minimize damage. It is a very important and promising area. That would be just one illustration.

Mr. DINGELL. I would like to compare that, let us say, to basic research in radio, electronics, rockets, missiles, biological, chemical or medical fields.

Mr. WILLIAMSON. This is one of the problems that we struggle with in the area of architecture.

There are no doctorates granted in the field of architecture, except honorary ones to the best of my knowledge.

Students take an additional year minimum to obtain a master's degree. Very few do go ahead for graduate work. It is a very limited number and those usually, I think, are motivated by a desire to go into the teaching profession. Also we should not lose sight of the fact that all the accredited architectural curriculums are 5 years in length so they already have another year, before they achieve their bachelor's degree. Definite research in this area is a very interesting problem.

Mr. DINGELL. I did not mean anything critical, Doctor, but I wanted to get your views on these things. When we spend the taxpayer's dollar, and I am sure you understand it, we want to get the best back for it.

Thank you very much for your presentation, Doctor, it was very interesting.

Mr. LOSER. Thank you very much for your appearance, Doctor.

Mr. WILLIAMSON. It has been a pleasure to be here.

Mr. LOSER. I believe that concludes the list of witnesses for this morning.

We will be in recess until tomorrow morning at 10 o'clock.

(The following statements were submitted for the record:)

STATEMENT OF AMERICAN SOCIETY OF CIVIL ENGINEERS TO HEALTH AND SCIENCE SUBCOMMITTEE OF HOUSE COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE AMENDMENT OF NATIONAL SCIENCE FOUNDATION ACT

The American Society of Civil Engineers has long been concerned with the problem of technical education. In a recently prepared policy statement concerning Federal aid to education, the society presented six points which are deemed vital to the achievement of the Nation's full technological potential. The following elaborates on the philosophy behind these points, with particular reference to amending the National Science Foundation Act.

1. "It is essential, in any legislation which may provide for increased Federal participation in education at any level, to guarantee that the autonomy of local agencies and individual institutions to determine educational philosophy, policy and procedures to retained."

The rapid technological growth which this country has experienced in its relatively brief history is directly traceable to the academic freedom of which we have been so proud. We have not had, and do not want, overall regimentation of our educational processes.

We are confident no member of your committee intends in any way to inhibit the fullest expression of local initiative. However, it is frequently all too true that "He who pays the piper, calls the tune." It is imperative, therefore, that in any program of financial assistance to education there be positive safeguards against the imposition of centralized philosophy on the agencies receiving such aid. Any action which might serve to restrict full expression of local initiative would diminish the ultimate development of the Nation's technical capacity.

2. "Any expanded Federal participation in education should be accomplished by the utilization of existing agencies rather than by the creation of new organizations."

It is a recognized fact that a multiplicity of regulating agencies tends to retard productive activity. Creation of new agencies diverts funds from productive channels to purely administrative ones. The economic burden of any Federal aid program will be sufficiently difficult in any event. Therefore, every effort must be expended to assure maximum application of funds where they are needed, at the local level.

There is in existence today an organization equipped and prepared to administer Federal programs involving science and engineering. It is the National Science Foundation.

3. "Any additional Federal funds which may be provided for education should be used for the encouragement of graduate study and for the improvement of teaching at both the collegiate and the secondary level, and that the funds provided for the physical, mathematical, biological, and engineering sciences should continue to be administered by the National Science Foundation."

Any program of Federal aid must concern itself not only with assuring an education for all qualified young people, but also with maintaining high standards of teaching. The Nation is already faced with faculty shortages at both the high school and the college level. School enrollments are climbing rapidly. Steps must be taken now to provide for an adequate supply of qualified teachers in the science and engineering fields. It will not serve the country to bring a greater number of students into the schools if we are inadequately prepared to teach the ones already there.

In the above paragraph, we have linked the high school and college faculties. The two problems are closely related. The development of a potential scientist or engineer begins in the high school science and mathematics classes. It is there that the spark of interest and curiosity in such matters is kindled. Students inadequately prepared in high school science and mathematics are, at best, severely handicapped upon entering college engineering curriculums. At worst, they may never find their way into engineering and science careers even though highly talented in this direction. We should not, and cannot, devote the precious and limited time available in college to teaching subjects better handled at the precollege level.

4. "Such legislation should increase the funds available to the National Science Foundation for the support of the physical, mathematical, biological and engineering sciences through research and graduate education."

It is strongly felt that this country will receive the greatest value per dollar spent in the support to education when such efforts are directed at the postgraduate level. There are several reasons for this. First, it is from this group that the great bulk of our capable teachers must come. Second, this is the frontier of our scientific and technological world. Funds expended in this area will serve not only to push back the wilderness of ignorance, but will also be increasing the pool of potential teachers of the future. Such funds also will serve to permit the development of our brightest young citizens to their fullest intellectual potential.

It is in this area where the greatest difficulty is encountered by ambitious, intelligent young men and women in furthering their education. The cost of graduate study is considerably higher than that of undergraduate work. A further difficulty lies in the fact that graduate students are at the age where many of them must contribute to the support of their families. The loss to the Nation is truly great if exceptionally talented youth, those qualified for postgradu-

ate study, must leave academic pursuits before their intellectual capacities are fully developed. The highly talented student is a rare and precious resource the Nation cannot afford to neglect.

5. "Grants for graduate study should be available both to full-time students and to teaching fellows engaged in part-time study."

As suggested above, it is imperative that steps be taken to increase teaching facilities. While plans presently made should be long range there is also an immediate need for increased faculties. It is therefore recommended that funds made available for graduate study should provide for teaching fellowships as well as full-time students. In this way, the Nation can avail itself of the abilities of the brighter students immediately.

Such a program would also serve to introduce to graduate students the possibilities of teaching as a career and help to encourage them in this direction.

6. "The proportion of National Science Foundation funds allocated to engineering sciences should be established on the basis of a realistic and unbiased analysis of need and the National interest."

In any program to advance the Nation's technology, it must be kept in mind that a balance must be maintained between the development of knowledge and its application for the benefit of mankind. Funds made available through the National Science Foundation should be allocated with this thought in mind.

The American Society of Civil Engineers wishes to express its appreciation for this kind invitation to express its views before the committee.

Respectfully submitted.

WILLIAM H. WISELY,
Executive Secretary, American Society of Civil Engineers.

STATEMENT OF DEAN F. PETERSON, JR., DEAN OF ENGINEERING, UTAH STATE UNIVERSITY

I urge passage of H. R. 2450 as a constructive step toward assuring that our supply of engineers does not dry up at the source.

Various estimates indicate that an increase of about 9,000 engineering teachers will be needed in the next decade or so in order to meet enrollment demands in engineering. Most of these should be educated at the doctor of philosophy level. We have produced only about 600 doctors of philosophy in engineering each year for the past several years. Statistics indicate that only about 80 of these go into higher education. In 1956–57, 739 new engineering teachers were employed—only 45 percent had a master's or doctor's degree. In contrast, in all fields of college teaching, of 8,308 new teachers employed in 1956–57 year, 77 percent had a master's or doctor's degree. Of all teaching fields, new engineering teachers had by far the lowest percentage of advanced degrees. We are scarcely getting enough engineers in higher education with advanced degrees to maintain our graduate faculties, which are increasing at the rate of about 250 per year.

This condition constitutes an attrition which will gradually pinch off the basic source of engineering scientific knowledge. Every year our situation grows worse. In a few more years we could lose even the seed by which we can regenerate ourselves by acceptable graduate instruction. This is a sad and critical situation for a nation which is competing for its survival almost directly on the basis of scientific and engineering excellence.

We must somehow provide the inducement to get top engineering talent into the graduate schools and into engineering teaching. An emergency condition exists and fast and decisive action is required.

I have two suggestions for inducing top engineering students to enter graduate schools:

1. Provision of a realistic program of fellowship specifically earmarked for engineering students and designed to attract the top college seniors rather than subsidize established researchers.

2. Improved quality of our engineering graduate schools. I have the misgiving that many of our engineering graduate schools are not good enough to interest top engineers.

We evidently cannot compete with Russia in numbers of engineers. Quality of education can be achieved only by inducing our top scholars to teach, and by assuring top-level graduate education for them. I, therefore, urge support of H. R. 2450 on legislation which will take direct action to induce superior engineering students to enter our graduate schools.

Salaries for engineering teaching are not competitive with industrial salaries for top engineers in spite of widespread impression to the contrary. This impres-

sion is brought about because a few engineering teachers are able to greatly supplement their incomes by consulting. Hourly compensation for engineering teaching is not competitive with compensation for engineering, especially if top engineers are considered.

The general problems of salaries for teachers are set forth in the Second Report to the President of the President's Committee for Education Beyond the High School, which urges that teachers' salaries should be doubled in the next 5 or 10 years. The statistics on the qualifications of new engineering teachers indicates that engineering teaching is generally the most critical area of all. Accordingly, I would urge that means be sought to bring compensation for engineering teaching into the most favorable possible competitive position for the services of top engineers.

An important requisite for an acceptable graduate school in engineering is a suitable research program. It is estimated that an institution needs research financing totaling from $25,000 to $75,000 for each engineering Ph. D. and somewhat less but very appreciable amounts for master's candidates. It is doubtful that conventional sources of funds for instruction can also provide the increased funds needed for research. A promising source of such funds is sponsored research, for which several bililon dollars are spent annually by the Federal and State governments and industry. Much more of this than at present could quite effectively be done coopertaively with graduate schools of engineering and science. Increased emphasis should be given by the Federal Government to sponsored research in graduate institutions. Perhaps some tax incentive could be provided to encourage the expenditure of increased industrial research funds in sponsored research in educational institutions.

(Whereupon, at 11:36, the hearing was recessed, to reconvene Friday, May 16, 1958, at 10 a. m.)

NATIONAL SCIENCE FOUNDATION

FRIDAY, MAY 16, 1958

HOUSE OF REPRESENTATIVES,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
SUBCOMMITTEE ON HEALTH AND SCIENCE,
Washington, D. C.

The subcommittee met, pursuant to recess, at 10 a. m., in room 1334, New House Office Building, Hon. John Bell Williams, chairman of the subcommittee, presiding.

Mr. WILLIAMS. This morning we continue hearings on bills to amend the National Science Foundation Act and bills to provide scholarships and fellowships in the fields of science.

The first witness scheduled this morning is Dr. Warren C. Johnson, dean of the division of physical sciences of the University of Chicago.

STATEMENT OF WARREN C. JOHNSON, DEAN, DIVISION OF PHYSICAL SCIENCES, AND VICE PRESIDENT, UNIVERSITY OF CHICAGO

Mr. WILLIAMS. Dr. Johnson, I believe you have a prepared statement.

Dr. JOHNSON. I have a short prepared statement which I should like to ampify if occasion permits.

Mr. WILLIAMS. You may proceed as you desire.

Mr. JOHNSON. I would like to speak in behalf of the bill H. R. 10293, which in my opinion is an important bill and has important implications.

I am speaking, I must say, from the point of view of basic research primarily, since I am not too familiar with applied and developmental and engineering research.

One of the important factors is the possibility of providing in universities long-term commitments by the Government agencies for fundamental and basic research. By long term I mean 2 years, 3 years, perhaps up to 4 or 5 years.

Basic research by its nature is not something which can be predetermined in terms of definite time schedules. It is unpredictable. Otherwise, it would not be basic research. There is a great need to maintain continuity in basic research programs over periods of 2, 3, to 5 years for a given project and contracts for such periods of time can be granted legally only if there are funds available to support them.

It is difficult to obtain personnel in the university to work on these programs if there is an uncertainty of their continuing for more than a year. Also, due to our governmental procedures the appropriations are not approved by Congress usually until midsummer, and it is very difficult to tell a promising young man in January or February, "We

do not know whether there will be a position for you next year in this program or not. You will have to wait until we hear from the particular agency and find out whether they have any money to support you" This makes it a very unsatisfactory situation.

I look upon the reserve fund proposed in the bill H. R. 10293 as a fund which would alleviate this situation and provide for the continuity in basic research we are so badly in need of promoting.

I would look upon this fund as being available to provide continuity in basic research programs not only for the National Science Foundation itself, but for other agencies of the Government supporting basic research, such as the Office of Naval Research, the Office of Scientific Research, the Office of Ordnance Research, and so forth.

In fact, about 10 years ago the Office of Naval Research did obtain such funds in the amount of, I think, $20 million to $30 million. The fund has not been spent, according to my understanding, but it has enabled the Office of Naval Research to write contracts for 2 or 3 years or more and provide a continuing program. This is the only agency I know which has had the authority to do this.

It seems to me that this reserve fund would be a very valuable one to be used more generally throughout the Government for this particular purpose.

As an example of the use of the fund in this connection, you will recall that last summer and early autumn the funds for basic research as provided by different agencies were cut back rather drastically, and this created a situation where in some cases it was necessary to give up programs in the university completely. If a reserve fund of this type had been available, it would have been possible to continue these programs, because most of them have been picked up again, say, 6 or 8 months later when funds did become available. Some of the manpower had dispersed in the meantime and it was a great loss to us.

It is my feeling that our greatest national scientific and technical asset is scientific and technical manpower, and that we should keep manpower occupied to the extent of their ability. When we allow them to drift and not support them to the fullest extent, we are not taking advantage of our greatest asset.

We are in strong competition with our enemies in this respect, and it is a national waste to have manpower working only on a part-time basis or not to full capacity; that is, having sufficient equipment, technicians, and assistants to carry out vigorous programs.

I do not mean that funds should be spent unnecessarily, not in the least. I understand that one feature of the bill is that there would be a controlling board which would review all programs, and when a program is not in keeping with what appears to be in the national interest and is not being operated efficiently, then it should be terminated.

On the other hand, we do have the responsibility of seing that we make the best use of our scientific and technical manpower.

Another feature of greatest importance in the establishment of the reserve fund is the flexibility it would provide in initiating new programs on an emergency as well as an urgency basis. The budgets of the Government agencies for the most part are prepared at least 2 years in advance of the allocation of the funds. It is impossible for anyone to predict with any degree of assurance what programs will be the most important ones 2 years hence, and it is more difficult

to predict what new programs may develop in this period. A reserve fund would enable the agencies to support new programs without the usual delay required by the normal budgetary procedures.

It is evident that our experience in the field of science during the past 6 or 8 months has forcibly brought to bear the need for emergency funds, both in the area of basic research and applied research. What I would like to speak to here is the area of basic research.

If funds had been available last autumn and immediately following the Russian Sputnik program, I can see in my own institution many places where we could have used such funds to advantage and, by so doing, we would be several months ahead of where we are now.

Mr. WILLIAMS. May I interrupt you at that point?

Dr. JOHNSON. Yes.

Mr. WILLIAMS. Do you feel that any such fund set up by Congress as has been advocated by Congressman Dawson should be used primarily for basic research rather than applied research?

Dr. JOHNSON. No. I think it should be used for applied research also, but I put the emphasis on basic research for two reasons. One is that I think applied research funds could be supplied from other sources, and also the National Science Foundation, since this refers to a change in the National Science Foundation Act. The Foundation itself was established for supporting basic research.

Mr. WILLIAMS. You do feel, though, funds should be used primarily for basic research?

Dr. JOHNSON. Primarily for basic research, yes.

Mr. WILLIAMS. You just mentioned a project which you might have carried on after sputnik had this fund been available. Would you give us specific examples of the types of projects you might have carried on if you had had the funds?

Dr. JOHNSON. One type of study is in the area of the study of cosmic rays. We have two programs at the university on which we are spending $250,000 to $300,000 per year in the cosmic ray field, exploring the upper atmosphere for the cosmic ray intensity, and so on. We could easily have doubled the effort here and obtained much more information which would be of interest and of value to all space programs. In fact, the National Science Foundation has now from its other funds done this very thing, has given us an additional sum of money to do exactly this. If the emergency funds had been avialable, they would have given the funds last October instead of 6 months later.

Mr. WILLIAMS. You received the funds some 6 months later. Had this fund been available, you would have gotten started on it 6 months earlier. Is that the idea?

Dr. JOHNSON. That is the idea.

Mr. WILLIAMS. One more question. Do you feel that projects which will require large expenditures in future years for construction purposes or maintenance purposes should be supported from this reserve fund? I have in mind the Midwest high energy project, for example.

Dr. JOHNSON. This is a special case. I happen to have been in the middle of this for a number of years, both due to the fact that I have been located in the Midwest and also because I am on the General Advisory Committee of the Atomic Energy Commission.

There are two complicating problems which I would like to mention. Of course, this is really aside from your point, but it is not yet

certain that the program is technically feasible. This should be determind first. The second and more important point is that if you do go into the high energy physics field to this extent, it should first be determined what percentage of your effort in fundamental science should be in high energy physics and in other areas during the next 5 or 10 years, not only in terms of dollars but in terms of manpower. I do not know whether you can do this or not, but at least a good effort should be made to answer these questions.

I can give you an example of what will happen if you get into these high energy physics programs, these accelerators. At the present time the Atomic Energy Commission is spending $16 million to $17 million per year in the support of high energy physics. It is building new machines, accelerators, all of which, four new ones, will be completed by 1961, or 1962 at the latest. When these are completed, on the basis of present-day dollars they will have to spend $50 million a year just to keep them going. If you take the mirror machine, which will cost at least $150 million, maybe $200 million, and add to it the Stanford machine which will cost at least $100 million and probably more before it is built, that is a $250 million capital investment.

From the experience of the past 10 or 12 years, we know that to keep machines going, whether a cyclotron or linear accelerator or cosmotron, the annual operating cost is about one-third of the initial capital investment. So you shall add to it another $60 million to $80 million.

The Stanford and mirror machines, if approved now, would not come into operation until 1965 or 1967. At that time, on present-day dollars, you would be spending $120 million to $130 million annually in the support of high energy physics alone.

Maybe this should be done. I do not know. But I think you must look very carefully at other fields of science to see whether spending this amount of money in one field is disproportionately high, see if you can determine to what extent other fields might suffer. Also, there is the point that when you spend a great deal of money in one field, you attract manpower into that field, thereby diverting manpower who might go into other fields. This has to be done.

It might well turn out that if the decision is made to go ahead, such a fund could be used for initiating the program, because for the first few years it takes only a few million dollars, and only after the design and engineering studies are completed do you spend large sums of money for big pieces of hardware—magnets, and so on.

Another example I might give is that in the field of astronomy, which now is becoming more and more important in relation to the space programs, we could easily have spent in one institution $200,000 or $300,000 more than we are now spending in astronomy. If emergency funds had been available last autumn, such programs would have been initiated.

These programs have to do with the measurement of the density of the dust in the neighborhood of the moon, other problems relating to the moon and to the planets, and so on. Now they are getting underway. The reason we are getting into these programs now is the interest in outer space, planetary space, but there has been a delay of 6 or 8 months or more before we could really get down to serious business in some of these problems in basic research.

I could give other examples where a fund of this type, looking upon it as an emergency fund in part, would be of great use to the basic re-

search program. I think it is obvious that having such funds available would enhance the program tremendously.

The two important points I have is the one I have just mentioned and the previous one about providing for long-term commitments, in which case you do not spend the fund but merely have it there for the purpose of being able to make long-term commitments.

I would like to say one thing in regard to the bill. I certainly would not like to see it used as a fund that everyone would dip into for some pet project, nor would I like to see it used to start large programs which might be difficult to stop and would commit the agencies to continue for some time.

However, I do not think there is much danger here as long as the board which administers it is composed of men who are farsighted and have had a great deal of experience in looking into similar problems. It should not be just a grab bag. That is the point.

I would like to see the fund kept intact in large measure for the long-term contracts and for emergency purposes.

I think that is all I have to say, Mr. Chairman.

Mr. WILLIAMS. Thank you very much.

Mr. Dingell.

Mr. DINGELL. I want to try to clarify one thing which has been before the committee for the past several days. Can you tell us specifically whether the reserve fund should be in the nature of a contingent fund purely for emergencies? Should it be used for a crash program where something is necessary, which might or might not be gotten until a meeting of Congress through the orderly processes of appropriation, or should it be just for giving discretionary grants by the advisory board which would administer it?

Dr. JOHNSON. I do not think it should be for the latter, discretionary grants. I think it should be mostly for emergency purposes and for the purpose of making it possible to write, as I said, long-term contracts.

Mr. DINGELL. You said for making possible long-term contracts.

Dr. JOHNSON. With the universities, in basic research, and with research institutes, as I mentioned earlier.

Mr. DINGELL. Would you call that a contingent fund?

Dr. JOHNSON. There is a word which is sometimes used, but nobody likes it. It is called "longevity" funds. This is a word which is used. It is not a good word. It carries the meaning. Longevity funds are not spent necessarily as long as you have appropriations coming in every year. It just sits there so you could legally write a contract.

Mr. DINGELL. The reason I ask that question is that one distinguished witness in the field of science the other day made an analogy between this fund and the fund which would be kept by the president of a university for research. He said that while he might use this type of fund, were he president of a university, for the setting up of a research program in certain fields with a certain definite aim and end, basic research into one particular field, into one particular chemical or physical phenomenon, he would not consider it for hiring a full professor, let us say, to join the staff of the university.

I was wondering what your comment would be on that.

Dr. JOHNSON. I think the situation is a little different, but I would agree to the extent that you would not hire a full profressor who would be on more or less permanent tenure and you are comitted to support him for maybe 20 or 30 or 40 years, unless you had the funds in the university or you could see funds forthcoming which would enable you to support him. I would agree to that extent.

I think it is difficult to predict in Government agencies and in Congress what will happen from year to year or over a long span, a period of 5, 10, or 20 years. I think you should not set up a new program unless it is really urgent. Such programs would have to be set up under any circumstances.

This reserve fund would provide the opportunity of establishing them early or immediately if they were determined to be urgent. Whether they are supported later on or not by congressional appropriations would be dependent upon their value and what they have accomplished.

I might mention one other item in this same connection, and that is the ARPA agency which was set up in the Department of Defense just a few months ago. ARPA is the Advanced Projects Research Agency in the Department of Defense. It was established on certain emergency funds, as I understand it, which the President had at his disposal to carry it until July 1. Then undoubtedly Congress will provide certain appropriations for its continuance.

Mr. DINGELL. It took over existing research projects in the Department of Defense, did it not?

Dr. JOHNSON. Yes. Some of the funds from the different services of the Department of Defense were transferred to it.

It was possible to do this because certain emergency funds were available. But emergencies of the future may be even more severe than this. We do not know. You cannot predict when sufficient funds will be available to go ahead to do something which is urgent.

Mr. DINGELL. That is all, Mr. Chairman. Thank you.

Mr. WILLIAMS. Mr. Bush.

Mr. BUSH. I have no questions, Mr. Chairman. I think it has been pretty well covered.

Mr. WILLIAMS. Mr. Loser.

Mr. LOSER. No questions.

Mr. WILLIAMS. Mr. Neal.

Mr. NEAL. The witness is a university man, and I would like to know, particularly as applies to the Department of Defense, who usually initiates programs for applied research.

Dr. JOHNSON. Applied research?

Mr. NEAL. Within the Defense Department. Are those programs to proceed along certain lines usually initiated by the Defense Department itself, or are the university people requested by people in the Defense Department to follow basic research along certain lines?

Dr. JOHNSON. In the area of basic research, essentially all the programs are initiated by the individual scientist in the university.

Mr. NEAL. I know. I made a mistake. I did not intend to refer to basic research. I intended to refer to applied research.

Dr. JOHNSON. In the case of applied research, I am not too familiar with the area because we have no engineering school at the University of Chicago. We do have some applied research programs. The initiation is on both sides, in my limited knowledge of the situation.

Mr. NEAL. That is a problem which naturally would have to be worked out. I would assume, not knowing too much about the organization, they would have a certain amount of facilities and perhaps some funds set aside for that particular branch of their work. Those things which can be engaged in properly and effectively through existing facilities in the Army, Navy, or Air Force would proceed along the line of investigating those things as far as they can. Certain phases of the investigation are perhaps beyond their ability or there may be certain phases in which they need additional help.

It would seem to me they would go to the university people for additional help.

Dr. JOHNSON. Yes.

Mr. NEAL. The question is, to what extent do the Army, Navy, and Air Force or the Defense Department receive appropriated funds for this particular activity? If they do receive funds, appropriations, to what extent do they meet their requirements? Would you be able to answer that?

Dr. JOHNSON. No, I would not.

Mr. NEAL. I am trying to bring out where is the duplication of funds? Where is the line of duplication in our appropriations when we appropriate to the Army and Navy and Air Force for research work and then again where we overlap that appropriation to other institutions engaged primarily in that type of investigation.

Dr. JOHNSON. I do not know.

Mr. NEAL. I do not believe we have any way of delving into it, but it is an interesting subject.

Dr. JOHNSON. Yes. I would say many such programs are initiated in the Department of Defense, with the Air Force, the Army, or the Navy. The general program may be initiated in the Department of Defense, but the details of defining the program may be arrived at and usually are arrived at by consultation with advisory committees and people in the universities.

Mr. NEAL. Would the National Science Foundation be the intermediary through which requests for additional research are made, say, on the part of the Army or the Defense Department, and the universities eventually carry it out?

Dr. JOHNSON. The National Science Foundation and its board and advisory committees could do this, I think, very well as it applies to basic research.

In the applied research area, my personal opinion is that I do not believe they really should be in the thing except as an advisory group, perhaps, on a limited scale. I do not think they should.

The Defense Department has a number of advisory committees who are capable of advising them on the problems they have at hand. As a matter of fact, there is a large number of such committees. I see no reason for pulling the National Science Foundation into this activity. That is my personal feeling.

Mr. NEAL. The Defense Department is at liberty to make arrangements and contracts with universities without any interference at all by the National Science Foundation. There should be a direct contact between the two.

Dr. JOHNSON. Yes. I think this is very valuable.

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Mr. WILLIAMS. Any further questions?
We thank you very much, Dr. Johnson.
Dr. JOHNSON. Thank you.
(Dr. Johnson's prepared paper follows:)

STATEMENT OF WARREN C. JOHNSON TO THE HEALTH AND SCIENCE SUBCOMMITTEE OF THE HOUSE INTERSTATE AND FOREIGN COMMERCE COMMITTEE AT HEARINGS MAY 16, 1958, PERTAINING TO H. R. 10293

I am Warren C. Johnson, professor of chemistry, dean of the division of the physical sciences, vice president of the University of Chicago, where I have been a member of the faculty for nearly 31 years. During the period, 1940–43, I was associated with the National Defense Research Committee in the administration of contracts in the area of the analysis and detection of war gases. In July 1943 I became associated with the Manhattan Project and spent nearly 2½ years at the Clinton Laboratories, Oak Ridge, Tenn., as director of the chemistry division. Since the beginning of 1946 I have been in administrative work at the university in the department of chemistry and the division of the physical sciences. During the period following the war, research programs in the division have been supported in part through contracts granted by several of the Government agencies. My position in these programs has been limited to the administrative duties. On the basis of this experience, there are a few statements I would like to make which bear on the bill H. R. 10293, the National Scientific Research Reserve Fund Act of 1958.

One of the most important implications of H. R. 10293, in my opinion, is that the establishment of a Scientific Research Reserve Fund would make it possible for the Government agencies supporting basic research to provide long-term contracts to universities and research institutes. Such long-term contracts are possible today only to a very limited extent. Basic research, by its nature, is not something that can be predetermined in terms of definite time schedules; it is unpredictable otherwise it would not be basic research.

There is a great need to maintain continuity in basic research programs over periods of 2, 3, to 5 years for a given project and contracts for such periods of time can be granted legally only if there are funds available to support them. Also, it is difficult to obtain personnel to work in the programs if there is an uncertainty about their continuing for more than 1 year. The reserve fund would not have to be spent to support long-term programs, provided Congressional approval for contracts were obtained from year to year. However, it would have the distinct advantage of being what it is called; namely, a reserve fund, which would enable the Agencies to legally process long-term contracts.

Another feature of greatest importance in the establishment of the reserve fund is the flexibility it would provide in initiating new programs on an emergency as well as an urgency basis. The budgets of the Government agencies, for the most part, are prepared at least 2 years in advance of the allocation of the funds. It is impossible for anyone to predict, with any degree of assuranc, what programs will be the most important ones 2 years hence, and it is more difficult to predict what new programs may develop. A reserve fund would enable the agencies to support new programs without the usual delay required by the normal budgetary procedures. It is evident that our experience in the field of science during the past 6 or 8 months has forcibly brought to bear the need for emergency funds, both in the area of basic research and applied research.

Our greatest asset in the field of science and technology is our trained manpower. We are being wasteful when we do not use this manpower to its capacity. In my opinion, a reserve fund would provide the flexibility that is needed to make certain that our scientific and technical manpower is used efficiently.

There are other arguments in support of the need for a national scientific research reserve fund. However, I believe that those I have mentioned above are of the greatest importance.

Mr. WILLIAMS. Our next witness is Dean Frederick C. Lindvall, president of the American Society for Engineering Education.

STATEMENTS OF FREDERICK C. LINDVALL, PRESIDENT; HAROLD L. HAZEN, CHAIRMAN, COMMITTEE ON DEVELOPMENT OF ENGINEERING FACULTIES; AND RALPH A. MORGEN, VICE PRESIDENT, THE AMERICAN SOCIETY FOR ENGINEERING EDUCATION, URBANA, ILL.

Mr. LINDVALL. There are three of us here representing the American Society for Engineering Education, and we have slightly different facets to our presentation. If it is agreeable to you, we might all three be here together, and then as questions come each one can take the appropriate one. Is that satisfactory?

Mr. WILLIAMS. That would be perfectly satisfactory, if the gentlemen will identify themselves for the record.

Mr. LINDVALL. Yes; each of us will give a separate statement.

Mr. WILLIAMS. Permit me to apologize for having to leave the committee hearing this morning.

(Off the record.)

Mr. DINGELL (presiding). You may proceed.

Mr. LINDVALL. Each of us will have a separate statement. I have with me here Dean Harold Hazen, of the Massachusetts Institute of Technology, the dean of graduate studies, and Dr. Ralph Morgen, of Purdue University, director of the Purdue Research Foundation. We wish to direct our remarks to matters in these bills which affect, as we see it, engineering education.

I shall read a short statement which I have, and the others will follow.

My name is Frederick C. Lindvall and my position as an engineering teacher is chairman of the division of civil, electrical, mechanical engineering, and aeronautics at the California Institute of Technology. I offer these comments as an individual, drawing on a background of 28 years of engineering teaching experience and the educational perspective I have been privileged to acquire as a member of the education and accreditation committee of the Engineers Council for Professional Development and as president of the American Society for Engineering Education.

The general trend of population growth will bring an increasing number of students to the engineering colleges, even though no more than the customary fraction of total college students enroll in engineering. Indexes such as the number of engineers per unit of population, the number of engineers per unit of employed workers, the number of engineers per unit of gross national product or per unit of industrial productivity, all suggest that the long-term national demand for engineers will increase.

The pressures and necessities of modern technology intensify the need for a basic engineering education which has extensive scope and depth in the fundamental sciences and the engineering sciences. For an increasingly large number of students this basic education is a foundation, a start, for professional work to be learned in practice and for graduate study which is becoming increasingly a necessity.

Admittedly a 4-year curriculum with this orientation must omit some of the engineering details which we have all been accustomed to present in our teaching and which have some immediate value to the young graduate if he happens to fall into work in the general area he has studied. But if our engineers of the future are to be identified with the highest levels of effort in technology, the advanced designs and the new materials and processes, we must accept the fact that a bachelor's degree program is insufficient for the highest level of professional engineering practice in the same way our colleagues in physics and chemistry expect the bachelor's degree to be an initial, rather than a terminal degree.

In the improvement of engineering education we are in most serious difficulty. We have not enough competent teachers in our engineering colleges to meet the needs of increased enrollment and higher quality of instruction. Evidently with more graduate work, there will be a greater demand for more teachers with advanced degrees. Nationally a large number of advanced-degree men ought to enter the teaching profession. A special study for the ASEE by its Committee for the Development of Engineering Faculties reveals that during the next 10 years, due to the normal growth of engineering-student enrollment, faculty retirements, loss to industry, and for other reasons, about 9,500 new teachers of engineering will be needed, or some 1,000 per year. Last year a national total of 590 Ph. D. degrees in engineering was reported. A few of these new Ph. D.'s entered teaching, but if all of them had done so, the number would have been too small. Next year will not be significantly better. Thus our problem, is, first, to encourage more of the best students to enter graduate school to prepare for a career in engineering teaching and research; second, to make a teaching career as attractive, competitively, as possible with reasonable pay and good basic research opportunities; and third, to do everything possible to assist existing engineering faculties to develop professionally in the new technological directions and improve in effectiveness in their teaching. For it is only from superior teachers that we can expect to obtain the superior graduates. There is no substitute for quality.

I would strongly recommend Federal scholarship assistance for graduate work in engineering which is specifically directed toward teaching so that the engineering colleges may offer substantial teaching scholarships which come wholly or in part from Federal sources. We must make graduate study financially attractive if the best young men are to find the path toward a teaching career a rewarding one.

Also, I would recommend that funds available for basic engineering research in the colleges be increased substantially so that in facilities and opportunities the young graduate students and the junior faculty members will find their academic research environment stimulating and adequate for their professional development.

That completes my part of the presentation.

If agreeable to you I would like Dean Hazen to proceed to amplify some of these points.

Is that satisfactory?

Mr. DINGELL. It would. Is there any member of the committee who would like to ask questions at this time?

(No response.)

Mr. DINGELL. You may proceed, sir.

Mr. HAZEN. My name is Harold L. Hazen. I am dean of the Graduate School of the Massachusetts Institute of Technology.

In recent years I served both as member and as chairman of the committee on accreditation and education of the Engineers Council for Professional Development.

Also, as Dean Lindvall has mentioned, I am chairman of the committee on the development of engineering faculties of the American Society for Engineering Education.

Like Dr. Lindvall I wish to speak as an individual in terms and for the benefit of the background that these and other professional activities imply.

Dean Lindvall has mentioned the problem of engineering faculties, manning our engineering faculties, which face the engineering profession in the years to come.

It has been the role of this committee on development, which with our permission I will abbreviate CDEF, it has been the role of the CDEF in the past year and a half to make a careful study of the nature and magnitude of this need.

About a month ago a report on this study was presented to the ASEE which shows that during the next 10 years the engineering enrollment of undergraduates is going to go up something like two-thirds, 66 percent.

The graduate enrollment will go up about 95 percent; it will nearly double. At the doctorate level it will somewhat more than double.

To man our engineering schools to take care of these increased numbers will require, in addition to our present numbers of faculties, at least three-quarters more, 75 percent more, but to achieve this increase in numbers will require recruiting during that 10-year time of more new people than we have in our engineering faculties today.

I cite these statistics to indicate the magnitude of the problem we are facing. We have to make a major increase in the size of the engineering education operation.

We have to make this increase in a competitive situation that today looks a bit discouraging but which we hope may be improved.

May I say, incidentally, that these figures are based upon the estimates of nearly 90 percent of the deans of engineering. They therefore take into account, on the part of the individual deals, the statistical bases, fraction elects engineering, fraction going to college, et cetera, they take these statistics into account but add to those statistics the subjective estimates that the dean who is on the firing line in his individual institution can bring to bear in making the best intuitive plus statistical estimates that he can of what is before him.

These same deans were also asked the question as to what increase in salary would be required in order to make engineering faculties competitive, not make the salaries competitive but make the positions competitive, with other positions competing for the top quality men that are necessary if our faculties are to do a first-grade job of education. That estimate is about 40 percent for the junior levels, for the full professor it is something like 56 percent.

This is the increase in salary today which would be required in the judgment of the individual deans to make faculty positions competitive for the top-quality men that are needed to keep up the quality of our engineering schools.

Mr. DINGELL. Would you give us a rough idea of what those same figures would be translated into dollars and cents?

Mr. HAZEN. The figure for a full professor, which was given us by the deans, is on the order of $1,250 per month for a full professor.

Mr. DINGELL. That is at present or is that projected?

Mr. HAZEN. That is the figure estimated to make the positions fully competitive.

Mr. DINGELL. The present figure would be on the order of $800 a month?

Mr. HAZEN. That is right.

Mr. DINGELL. That would be for a full professor. How about for one who is junior?

Mr. HAZEN. Well, at the most junior level, if you will, the industrial figure is on the order of $475 to $500 a month. I would say, and I would like to check with my colleagues here, that perhaps $400 a month plus some academic privileges would make it competitive.

Mr. LINDVALL. It would be closer to $500.

Mr. HAZEN. It would have to go somewhat higher?

Mr. LINDVALL. Bachelors being hired by industry now at $475 to $500 a month. We are trying to hire Ph. D.'s as engineering teachers for comparable dollar salaries.

Mr. HAZEN. We do not differ. I was thinking of the junior staff man who would have some privileges as a graduate student while he is doing junior duties, so our two figures do agree entirely.

To give just one more figure in this general picture, if we add this 40 to 50 percent increase in salary necessary to make positions competitive, then look ahead 10 years, add three-quarters to our manpower total count in the faculties, we increase the salary bill for teachers of engineering subjects from the present $60 million to approximately $150 million.

If, as seems realistic in terms of our economist associate friends, we say that the general level of salaries in all probability will appreciate during a 10-year period and use what our economist friends feel is a sound figure for this, 3 percent a year, the total salary bill for engineering faculties in this country 10 years hence looks like about $200 million as compared with the present $60 million.

So much for the general setting, Mr. Chairman and gentlemen.

What conclusions or morals can we draw from these data? Well, it is obvious that we are not competing successfully for an adequate number of new recruits to the teaching profession at the present time. In fact, one of the observations of the deans describing what they have been seeing particularly in the last few years is that they are losing their top-quality faculty people to industry, actual faculty people they are losing to say nothing of not being able to attract as many of the high quality new people as they need.

The natural occupation for an engineer who is finishing school is in industry. Engineering is designing and building things. Industry is the normal place for such a person to go.

It requires a little special attraction oftentimes to get him to think seriously about graduate study.

He may have met the girl, he wants to establish a family, financial responsibilities are bearing in on him, he sees the opportunity of a junior assistantship at substantially less than industry would offer him as something he will not think too seriously about.

We need to do all we can to encourage more of the first-rate young graduates to go on to a residential graduate school, residential as contrasted to industry employment and night courses.

I say that from our observation of experience over recent years it is very clear that the great predominant source of new faculty for our engineering schools is from the residential graduate school operations.

In the residential graduate school the graduate student comes in close association with faculty members who themselves are teaching, who are doing research work or living the academic life.

Also, a matter of practical expediency comes in to help us there. This young man is in need of support. He will, if a little persuasion is applied, think in terms of a teaching assistantship or research assistantship to help him out financially.

It is at this point that the future engineering teacher is more frequently made than at any other point.

He takes a class, perhaps with a little reservation to begin with, but he discovers in many cases that this is an exciting and fascinating occupation, that the privilege of working with bright young men and teaching them is indeed a worthwhile and a very fine kind of experience.

Therefore to get men in this position where they will be exposed to this sort of experience seems to most of us to be the critical point in providing recruits to our engineering faculties.

How can we encourage this phenomenon to take place? I would like to quote from a statement which was prepared in behalf of our committee by Dean Everitt, of the University of Illinois, who incidentally is a member of the CDEF and which was transmitted to Dr. James R. Killian, Jr., Special Assistant to the President for Science and Technology, under date of December 17. This is 3 or 4 months old but it is just as valid today as it was at that time and we suspect it will remain valid for a considerable time to come.

We say here that the most critical shortage affecting engineering education at the university level is, and will be for the next decade, the shortage of engineering teachers. This is first and foremost the critical problem.

We point out in this statement that support for research in the engineering colleges is an important element in attracting young men to graduate school and supporting them while they are there and attracting them because it can help support them, and therefore means of funding research programs on a larger scale than they are being funded at present is a vital step in this process of adequately supporting graduate work in the residential schools.

Present support comes from research projects in the Department of Defense, particularly those of a basic nature.

It comes from research projects of the Atomic Energy Commission.

It comes from research projects of the National Science Foundation.

It comes from fellowships of the National Science Foundation. All these means of support do help finance the graduate student and help him to see that he can be financed if he elects graduate work.

We would emphasize in this connection that while it is evident that the needs of the future call for expansion of the support of basic research in engineering, such expansion cannot be undertaken by universities on a sound and continuing basis unless the true cost of this expansion is supported by the sponsors.

If we are going to blow this up to any considerable degree, the institutions simply do not have the uncommitted resources with which they can carry a substantial part of this cost. The expansion must be financed by outside sources.

More specifically our recommendations include, and these are contained in the supporting document which I will give to the clerk:

It is recommended that Federal agencies supporting basic research in engineering should—

(1) Increase the number of basic research contracts with the universities.

(2) Encourage the use of graduate students on basic research projects, recognizing that an important return to all agencies of the Government is the development of technical competence, as well as the actual research accomplished.

(3) In each project, support the portion of the faculty salary used to direct the project and give guidance and instruction to the graduate students involved.

(4) Provide longer term contracts of the order of 5 years so that areas of competence in each educational institution may be developed and supported without straining the educational resources through contract instability.

(5) Pay adequate indirect costs so that other resources of the educational institution are not tapped to support Federal projects.

(6) Provide means for the construction or enlargement of buildings required for these research projects. For example, a possible means would be Federal loans and provision for their retirement from contract funds.

That applies to supporting research activities. I mentioned earlier the teaching assistantship was perhaps the key element in attracting the young graduate students into considering, at least, faculty careers.

In order to help encourage this teaching activity, we offer the following suggestions:

(1) Winners of National Science Foundation fellowships in the first or second year be granted an additional but separate stipend if they are given limited teaching assignments of the order of quarter time at the university of their choice. It is believed such a limited teaching experience could be undertaken without a reduction in academic load, and might whet the student's appetite for an academic career.

(2) National science fellowship-teaching assistantships be set up with universities on a matching basis, the fellowship being a grant to support the student for his part-time studies—the assistantship to be paid by the institution for the time devoted to teaching. In this way, earnings of young engineers in graduate school who are teaching could be made more comparable with industrial salaries.

(3) Those who receive honorary mention in the competition for national science scholarships be given a grant of say, $500, if they accept teaching assistantships at a university.

Some of the very able fellows who can get fellowship support for an entire teaching career are a little inclined to say "I don't want to waste my time teaching." This is their interpretation of it. If they are given additional incentive to undertake some teaching they discover, (*a*) that it is a very fascinating sort of occupation; (*b*) they learn that this in itself is one of the best means of education. Nothing enables one to learn quite as effectively as having to teach it to a bunch of critical, bright youngsters facing one in a class.

(4) The number of national science scholarships for the first year of graduate work in engineering be increased substantially.

This is the critical time when the boy is making his career decision between industry and graduate school and we need to do all we can

to furnish an additional urge for him to consider graduate study seriously.

The development of this plan would allow more engineering students to follow a program looking toward the doctorate of the following general character:

One year of study leading to the master's degree or equivalent with possibly a partial experience in teaching.

Two years of combined teaching and course work on fellowship-teaching assistantships.

Finally, 2 years of basic research work which in most cases would complete the requirements for the doctorate. This is not a rigid pattern but this combination of perhaps a year of full-time study, a year, a year and a half or 2 years as a teaching assistant, and 1 to 2 years as a research assistant, makes a package that I think those who are concerned with graduate study generally across the country recognize as having exceedingly high educational value and being just a first rate kind of package leading to the doctorate.

I think, sir, that this presents the principal ideas that I would like to lay before your committee.

Mr. DINGELL. Did you want that made part of the record?

Mr. HAZEN. Yes.

Mr. DINGELL. If there is no objection it will be made part of the record.

(The statement referred to follows:)

THE AMERICAN SOCIETY FOR ENGINEERING EDUCATION,
Urbana, Ill., December 17, 1957.

DR. JAMES R. KILLIAN, JR.,
Special Assistant to the President for Science and Technology
Executive Office Building, Washington, D. C.

DEAR DR. KILLIAN: That the Nation is facing a great oncoming tide of additional students in its colleges and universities during the next 10 years is widely recognized. Hence we shall be critically short of college teachers, and this shortage will be especially acuate in engineering where the competition of industry and Government for the ablest college graduates is greatest.

Sensing the urgency being felt at the national level about this problem, the committee on the development of engineering faculties of the American Society of Engineering Education respectfully submits to you the accompanying statement and recommendations that it believes important in the national consideration of this problem.

The primary need is for more of our ablest recipients of bachelor's degrees in engineering to enroll in our full-time residential graduate schools because it is this source that chiefly produces our engineering faculties. Therefore adequate support of these students and of the augmented needs of these graduate schools is of the utmost importance.

Copies of this letter and its attachment are being sent to a number of other persons who are seriously concerned with this problem.

Sincerely yours,

HAROLD L. HAZEN,
Chairman, Committee on the Development of Engineering Faculties.

THE NATION MUST SOLVE ITS ENGINEERING FACULTY SHORTAGE

Recommendations of the Committee on the Development of Engineering Faculties of the American Society of Engineering Education [1]

FACTS BEARING ON THE PROBLEM

The most critical shortage affecting engineering education at the university level is, and will be for the next decade, the shortage of engineering teachers. Of secondary but critical importance is the deficiency in laboratory, classroom,

[1] This proposal was drafted for the committee by one of its members, Dr. W. L. Everett, dean of engineering, University of Illinois.

and office space. These resources are insufficient for present enrollment and for those we expect. Therefore, unless and until these critical shortages are relieved, programs which aim primarily at increasing the supply of undergraduate engineering students beyond those now in sight are highly questionable. On the other hand, programs to support improvement of their high-school preparation in English, mathematics, science, language, and history are most important.

Engineering and physical science are expanding explosively in their demands for keen insight and a high level of educational attainment. The principal source of new teachers who can meet the needs of this scientifically based technology must come from the graduates of our resident graduate schools, particularly those who complete the doctorate. "Resident" work is emphasized because experience has shown that students who take graduate work on a part-time basis while employed in industry are almost never attracted to academic careers.

Engineering graduates find industrial life attractive or they would not have chosen engineering in the first place. Therefore, the problem of inducing an adequate portion of those with the best minds to enter teaching is particularly difficult in the field of engineering. The large salary differential in early years, when families are being established, has made the problem particularly critical at the present time.

Engineers and scientists with bachelor's degrees will not attend graduate school if they are solely dependent on their own or their families' resources. Therefore, the supply of resident students for engineering graduate schools depends upon support in the form of scholarships and assistantships. The principal sources of such support are the institutions themselves, the Federal Government, and, to a limited extent, industry. Currently, the major forms of Federal support for engineering graduate work are:

(1) Research projects of the Department of Defense, particularly those of a basic nature.

(2) Research projects of the Atomic Energy Commission.

(3) Research projects of the National Science Foundation.

(4) Fellowships of the National Science Foundation.

A research program is the most essential and costly component of advanced education leading to the doctorate. Modern technology requires laboratory facilities and instrumentation which are fantastically expensive when compared with prewar standards. It is doubtful if more than a tiny trickle of adequately trained Ph. D.'s in engineering could be supplied by the educational institutions of the country if these institutions were dependent solely on their own resources. The importance of the basic research programs supported by the Federal Government is indicated by the fact that, as the funds for these programs leveled off, the number of Ph.D.'s graduating in engineering in the United States followed the same pattern, becoming practically constant for the past 5 years at about 600 per annum.

Conclusions

The leaders in Government should recognize that the support of basic research in engineering and the form in which it is offered are of the utmost importance to the Nation. It will determine not only the level of research accomplished, but also the supply of individuals with the requisite background to educate engineers in an age when basic understanding of scientific principles must replace dependence on intuition and experience. From this same source must also be drawn the engineering and scientific leaders in industry and government.

It seems evident the needs of the future call for expansion of the support of basic research in engineering. But such expansion cannot be undertaken by universities unless the true cost of this expansion is supported by the sponsors. These same universities are being called upon to take care of an undergraduate student population increasing because of the greater birth rate and an enhanced evaluation of the worth of higher education.

The true costs of an expanded basic research program include the support of the faculty salaries needed, not only to direct the projects, but also to guide and instruct the graduate students involved. Expansion also introduces increased costs for buildings to house the laboratories and offices required by an enlarged faculty and graduate student body. It is no longer possible to obtain such space by diverting existing classrooms and instructional laboratories and crowding offices as has been done repeatedly in the past. The current allowances for indirect costs should also be reevaluated, since there is serious question as to the adequacy of present allowances. Furthermore, it should be recognized that costs increase if programs are unstable and frequent renegotiation is necessary or periods of nonsupport are recurring.

PROGRAM RECOMMENDATIONS

Part I

It is recommended that Federal agencies supporting basic research in engineering should—

(1) Increase the number of basic research contracts with the universities.

(2) Encourage the use of graduate students on basic research projects, recognizing that an important return to all agencies of the Government is the development of technical competence, as well as the actual research accomplished.

(3) In each project, support the portion of the faculty salary used to direct the project and give guidance and instruction to the graduate students involved.

(4) Provide longer term contracts of the order of 5 years so that areas of competence in each educational institution may be developed and supported without straining the educational resources through contract instability.

(5) Pay adequate indirect costs so that other resources of the educational institution are not tapped to support Federal projects.

(6) Provide means for the construction or enlargement of buildings required for these research projects. For example, a possible means would be Federal loans and provision for their retirement from contract funds.

Part II

Further steps are also needed to guide more graduate students into teaching.

All engineering educators agree that teaching is itself a most effective means for educating the teacher; therefore, teaching experience should be included in a well-rounded advanced education program. When one is called upon to explain a difficult concept to others, he is really driven to deepening his own grasp of the fundamentals. Furthermore, experience has shown that an appreciable proportion of those who have an opportunity or obligation to teach engineering are attracted to it as a career. Those who do not have such an experience seldom choose an academic life. Therefore, every qualified engineering graduate student should be given not only an opportunity but an obligation to assist his university in the teaching program.

It is proposed, therefore, that—

(1) Winners of National Science Foundation fellowships in the first or second year be granted an additional but separate stipend if they are given limited teaching assignments of the order of quarter time at the university of their choice. It is believed such a limited teaching experience could be undertaken without a reduction in academic load, and might whet the student's appetite for an academic career.

(2) National Science fellowship-teaching assistantships be set up with universities on a matching basis, the fellowship being a grant to support the student for his part-time studies—the assistantship to be paid by the institution for the time devoted to teaching. In this way, earnings of young engineers in graduate school who are teaching could be made more comparable with industrial salaries.

(3) Those who receive honorary mention in the competition for National Science scholarships be given a grant of, say, $500, if they accept teaching assistantships at a university.

(4) The number of National Science scholarships for the first year of graduate work in engineering be increased substantially.

The complete program recommended provides for support of the expensive research area of graduate programs through an evolutionary but not revolutionary change in present Federal policies.

The development of this plan would allow more engineering students to follow a program of the following general character:

One year of study leading to the master's degree or equivalent with possibly a partial experience in teaching. Two years of combined teaching and course work on fellowship-teaching assistantships. Two years of basic research work which would in most cases complete the requirements for the doctorate.

The proposed program would increase the critically inadequate supply of well-educated engineers and an appreciable proportion should become interested in teaching careers.

Mr. LINDVALL. Dr. Morgen will be the next witness.

Mr. LOSER. I have been tremendously impressed with your very enlightening statement, Dean Hazen. I am sure, in the record as it is will be most impressive among the members of this committee who are absent.

Mr. DINGELL. Further questions?

Mr. NEAL. I want to commend the doctor on his fine statement.

Mr. DINGELL. Would it be a fair statement to say that in other fields of scientific and technical endeavor you are faced with the same problem insofar as furnishing a growing and adequate and competent teaching staff to perpetuate that field of science concerned?

Mr. HAZEN. This is an excellent question and I would like to comment on it if I may.

First let me say I will claim no special privilege for engineering by any manner of means. Let us go away to the social sciences, the life sciences. All of these are important. Engineering has no special claim to special attention except as it may have some unique problems.

Does it have unique problems? I think as compared with pure science it does have some problems. The natural career, or a very natural career, for a pure scientist is that in an academic institution. I think it is safe to say the majority of pure scientists look upon this as at least a 50–50 or higher probability for a career.

The normal career, as I mentioned earlier, for the engineer is in industry, so this contrast or comparison means that engineering is under a little special handicap in attracting its members to an academic scholarly career.

The fellows have to think twice before they go to teaching.

Evidence on this point has been supplied by studies which have been made as to when and how a career as a teacher has first been considered or stimulated in students.

In the nonengineering fields of science and in the arts this choice tends to be thought about with some degree of seriousness as early as the early undergraduate years in college.

In the case of engineering teachers this choice tends to be made somewhere during the first or second year of graduate study. It comes later. If we do not get the fellow into graduate school our chances of showing him the opportunities of the teaching career are very largely missing.

Therefore I think in this way engineering faces some handicaps that the other sciences and academic fields do not encounter.

I suspect that business shares somewhat more the characteristics of engineering than it does literature or physics, let us say.

Mr. DINGELL. Would you say, Doctor, that other fields of scientific endeavor face similar, if not identical, problems in securing competent students to go on in the graduate field?

Mr. HAZEN. Here again engineering and the sciences are somewhat different. In physics, chemistry, or mathematics the person who does not have the doctorate degree just does not rate. His education has been cut off midway and he just has not gone far enough to be useful, so the doctorate is the normal academic ambition and end point for a scientist.

In the case of the engineer the 4-year undergraduate program leading to the bachelor's degree is quite sufficient for a large proportion of the men to enter industry to perform exceedingly useful functions and to serve as a basis for a thoroughly satisfying career.

The engineering background and competence in elementary matters is quite sufficient to enable him to face intelligently the problems that he has to meet of a not too highly technical level.

Here again the doctorate is the normal course for the scientist.

The bachelor undergraduate program is more nearly the normal for the engineer. The fellow who goes on to graduate work is 20 percent of the population whereas in science I suspect it is nearer 80 or 90 percent.

Mr. DINGELL. You think 20 percent is enough in the other fields?

Mr. HAZEN. In the sciences something like 70, 80, or more percent go on to the doctorate ordinarily, quite normally, without any special stimulation; is that responsive?

Mr. DINGELL. Do you have a chemistry and physics department at your school?

Mr. HAZEN. Yes.

Mr. DINGELL. Would you say you are overstocked in competent and adequate teachers in physics and chemistry?

Mr. HAZEN. No; we are not overstocked. Nobody is overstocked. However, the deficiency, present and prospective, is somewhat less there than it is in engineering.

Mr. DINGELL. You do have a deficiency, then?

Mr. HAZEN. In engineering there is presently a deficiency of nearly a seventh.

Mr. DINGELL. I referred to the other sciences. Do you have a deficiency in them?

Mr. HAZEN. I would say by very strenuous efforts we at our institution come out even in the sciences.

Mr. DINGELL. How about other schools?

Mr. LINDVALL. At the California Institute of Technology we are having no special trouble getting people into physics and into chemistry instruction. We have no serious difficulty there. The same is true for biology and geology. Our most serious difficulty is in engineering.

Mr. DINGELL. I believe we have yet to hear from Dr. Morgen.

Mr. BUSH. One thing, Mr. Chairman. Dr. Hazen's presentation here relative to the teaching situation has been tremendously impressive. I think it will be a great deal of help to the committee.

Mr. DINGELL. Dr. Morgen, we will be glad to hear from you at this time.

Mr. MORGEN. Mr. Chairman, it is a pleasure to have this opportunity to meet with you.

My name is Ralph A. Morgen. I am presently vice president of the American Society for Engineering Education with responsibility for the Engineering College Administrative Council of that society. I am likewise chairman of the engineering sciences committee of Engineers' Joint Council and chairman for region II of the committee on education and accreditation of Engineers' Council for Professional Development. After receiving my degree of doctor of philosophy from the University of California in 1925 I had 13 years of experience in industrial research and development. From 1938 to 1952 I was associated with the University of Florida as professor of chemical engineering and director of the engineering and industrial experiment station. From 1952 to 1954 I was with the National Science Foundation where I became the first program director for engineering sciences. In 1954 I became professor of chemical engineering at Purdue University and research director of the Purdue Research Foundation which is my present capacity.

I would like to say at the outset of my statement that I agree with the viewpoints expressed by Dean Lindvall and Dean Hazen. They

have presented to you the problem facing higher education in engineering. I shall try to follow their statements with (*a*) a brief analysis of the bills which are now before your committee and have a bearing on support to engineering education, and (*b*) some general suggestions which I hope will be helpful to your committee in its deliberations to find at least a partial solution to some of these problems.

H. R. 2450 plans to amend the National Science Foundation Act of 1950 in several respects. It would permit the Federal Government to pay supplemental increments to the salaries of engineer professors so that those salaries would be competitive with comparable industrial positions. This is laudable and desirable in its objectives but the method suggested is open to serious question and almost insurmountable administrative difficulties. I have a simplified suggestion which I believe will accomplish most of the objectives with much less serious objections. I will discuss this a little later.

This bill likewise provides for undergraduate scholarships. The present National Science Foundation Act allows the award of such scholarships but it has not seemed desirable to implement this phase of the program for reasons which I will discuss later.

The section of this bill on the awarding of fellowships provides that the recipient of the fellowship shall teach at a secondary school for a period of 3 years before obtaining his advanced degree in engineering. There is some question in my mind whether the same person who would be motivated to teach science and preengineering subjects in the secondary schools would be the type of individual who would wish to obtain an advanced degree in engineering.

H. R. 4218 is a bill to amend the National Science Foundation Act to provide undergraduate scholarships for those who have passed an examination in mathematics. In addition to the fact that the present National Science Foundation Act already permits such scholarships, I believe that a provision supplying many more undergraduate scholarships appears premature until the assurance of a supply of teachers for higher education is at least partially solved.

H. R. 9918 is quite similar in purpose to H. R. 4218.

Mr. BUSH. Is it your opinion that the serious problem facing your school today is not the student but the lack of qualified teachers?

Mr. MORGEN. That is correct. It will be time enough to worry about getting more students 10 years from now. We must solve the teacher and graduate student problem first. That is our thesis in essence.

H. R. 10180 provides for additional undergraduate scholarships and graduate fellowships. Both of these authorities are in the present National Science Foundation Act and thus an amendment to the act does not appear to be needed for these points. In addition, the bill would award the graduate fellowships on the condition that the fellows serve several years as teachers in secondary schools. It permits the fellow to select any approved school of engineering or science for his graduate study. The two major objections to these provisions are (*a*) would the same individual who would teach at a secondary school be the best individual to study for an advanced degree in engineering and, (*b*) allowing the fellows to select their institutions would tend to cause overcrowding at a few selected institutions and scarcity at many other institutions.

H. R. 10293 would provide the National Science Foundation with a special scientific reserve fund of $200 million. This fund would

permit the National Science Foundation to act rapidly when new scientific breakthroughs occur. It would seem to me that this objective could be accomplished equally as well by providing in the annual National Science Foundation budget a contingency fund of sufficient size. Thus it could act promptly to capitalize on any scientific breakthrough. Then a direct request would be made to the Congress the following year for specific appropriations based on the facts as they exist at the time.

H. R. 10456 merely provides for graduate scholarships and is open to the objections which I have cited above.

H. R. 10464 provides for summer institutes for science teachers as well as undergraduate scholarships. My comments apply to these two items as noted above. The National Science Foundation now has such authority if it so desires to exercise it with the funds available to it.

H. R. 11257 clarifies the National Science Foundation Act by directing the Foundation to award scholarships and/or fellowships in a wide distribution among the States, Territories, and possessions. In addition, it provides for the support of appropriate research in countries other than the United States and to enter into more foreign assignments. These are laudable and desirable objectives. Such authority given to the National Science Foundation would, in my opinion, approve its effectiveness.

With this very brief analysis of each of the bills under consideration at this time I would like to suggest that the National Science Foundation now has authority in its present act to undertake the solutions which I am suggesting below providing that the Congress will supply appropriate funds to implement the suggestions. It should be noted that in order to implement these suggestions the National Science Foundation needs additional appropriations specifically earmarked for the support of research, preferably in engineering sciences. It is my understanding that the 1958 fiscal year appropriation bill for the National Science Foundation supports the area of training in the sciences to an extent which is out of proportion to the support given to basic research.

The suggestions for immediate action are as follows:

1. Without implying Federal control of education and without requiring new legislation, it is possible for the Congress to provide an increase in salaries for substantially all the engineering professors in higher education to the amount of 25 to 33 percent. The plan is this: Most engineering teachers are employed on an academic-year basis of 9 or 10 months. In the summer months they are free to engage in professional activity including research and other activities that will make them better teachers and professional men. However, the present low salaries force many of these teachers to engage in subprofessional activities during the summer months in order to make ends meet.

If funds were available to the National Science Foundation under its present legislative authority, it could award research grants for pursuit of basic research and scholarly activities by staff members during the summer months and pay to those staff members, through their institutions, the same monthly stipend which the institution pays during the academic year. A rough approximation of the cost of such a program is $36 million for engineering. This is based on the

assumption that there are 9,000 engineering professors at the present time with an average stipend of $700 a month during the academic year. If these 9,000 professors were paid $2,100 each in the summer, the total cost would be a little less than $18 million a year. Add to that sum an additional $18 million to take care of materials, supplies, equipment and the indirect costs of the universities, the total appropriation needed, if every professor of engineering in the United States applied for this kind of support, would be about $36 million a year. This is somewhat less than the amount proposed in several bills for undergraduate scholarships.

Mr. LOSER. How do the salaries paid engineering teachers compare with salaries of other teachers?

Mr. MORGEN. About the same. The teachers try hard to keep the salary levels at least comparable. It is an administrative problem. They have been forced in the last few years to increase the salaries of engineering professors slightly more than for other professors, but most university administrators do not like that because it causes trouble in other areas.

This support would be placed on a purely voluntary basis where each professor who wished to receive support would make his request to the National Science Foundation as is now the case for any other research support. These types of requests would be judged on a somewhat different basis than the support of research in which the major objective is a specific basic research result. Many of the senior professors would not apply for this type of support since they will continue to have consulting support from industry during the summer months.

This proposal outlines what could be done immediately to increase the salaries of engineering professors by 33 percent without raising the question of Federal control of higher education. The salary rates would continue to be those set by the universities and there would be no question of interference by the Federal Government in the internal affairs of the university.

2. By the method outlined above, the stability of the present engineering staffs could be maintained. The next question is how to find replacements due to natural attrition plus the expansions in staff that will be required in the next decade. As Dean Hazen indicated, the engineering colleges will have to find more than 7,000 additional new staff members by 1967. This will require an immediate increase in the number of persons engaged in advanced degree study in engineering. The bottleneck is the extreme competition for the short supply of the most capable graduates in engineering. If there is to be an appreciable increase in the number of engineering students attending graduate school, increased incentives must be found. At the present time it is possible to offer engineering graduate students either a teaching assistantship at $1,800 to $2,000 per year or a fellowship which requires no duties at approximately the same stipend. One of the greatest disservices that the Congress could do to higher education would be to increase greatly the number of fellowships so that students would not accept teaching assistantships. This would increase the cost of instruction at the institutions of higher learning. It is therefore suggested that the National Science Foundation offer fellowships to the universities which would be given to supplement teaching assistantships. Thus, a fellowship would be given to an

institution in the amount of $1,800. This amount would be matched by the institution with an amount of $1,800. Thus the student would earn $3,600 during the calendar year. He would pursue his graduate studies part time during the academic year and full time during the summer session. When the student becomes sufficiently advanced so that he is ready to engage in a research program suitable for his thesis he would no longer receive the free grant fellowship. He would then receive a research assistantship which could be made available from the National Science Foundation or some other agency which is supporting research at the institution. It is believed that this combination would substantially increase the supply of graduate students in engineering. By providing that these students must engage in some teaching activities it is believed that a reasonable proportion of these students would be motivated to remain in the teaching profession.

Once the student has received his advanced degree and has accepted a position at an institution of higher learning as an instructor or assistant professor he would then be eligible for a research subsidy as noted in (1) above.

3. Upgrading of secondary-school teachers could be accomplished by an expansion of the present type of summer institute programs for secondary-school teachers which the National Science Foundation now has in operation. It is believed that the funds that will be available to the National Science Foundation in fiscal year 1959 for this purpose will be as large as the Foundation can properly dispense. If the National Science Foundation staff finds, as a result of this year's operation, that it can expand the program for the benefit of the secondary-school teachers even further, then increased appropriations for that purpose can be requested in the 1960 fiscal year.

4. This brings me to the question of the number of undergraduate scholarships that would be desirable in engineering. It appears that until the teacher-shortage problem and graduate student shortage problem is at least partially solved the encouragement of additional undergraduate students in engineering would be undesirable. It is believed that the enrollment of undergraduate engineering students will increase to the limit of the present staff capabilities and facilities without artificial stimulus. It is true that some persons who could benefit well from engineering education are not motivated at present to take engineering subjects and some persons who are not good engineering material are attempting to enroll in engineering. This is a different subject and should be handled by proper counseling in the secondary schools or even earlier.

When it has been shown conclusively that there has been a substantial improvement in the salary level of teachers of engineering education and when there has occurred a decided upturn in the number of graduate students who are planning on academic careers in the engineering profession, it will be time enough to consider the need for increasing the number of undergraduate engineering students through scholarships. To summarize very briefly therefore, it is my belief that

1. Except for technical changes as embodied in H. R. 11257 there does not appear to be need for an amendment to the National Science Foundation Act at this time.

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2. The salaries of engineering teachers in the institutions of higher learning can be increased by approximately one-third through appropriation of sufficient funds for basic research to the National Science Foundation under its present authority and present act.

3. The supply of engineering teachers can be increased by giving grants to graduate students through the institutions rather than direct to the students. These grants would supplement teaching assistantships now available through the institution's own funds.

4. The lot of the secondary-school teachers of science and preengineering subjects can be improved substantially by a continuation and expansion of the present summer institute program for secondary school teachers now in operation by the National Science Foundation.

5. Expansion of scholarships for undergraduate students does not appear desirable until after there has been accomplished an improvement in the salary status of the teachers of engineering subjects in the institutions of higher learning, and until methods have been devised for increasing the number of such teachers through the proper support of graduate education in engineering.

6. The increase in appropriations needed to activate these suggestions would be less than those proposed in the present bills before this committee.

Mr. Chairman, I thank you for giving me this opportunity to appear before you.

Mr. DINGELL. I would like to thank you, Dr. Morgen.

Are there any questions of Dr. Morgen?

Mr. LOSER. Nothing except to say it was a very fine statement, Dr. Morgen. You gentlemen as a panel have made a great contribution to our work here.

I am sure it will be of great benefit to the Congress.

Mr. DINGELL. Mr. Bush?

Mr. BUSH. As I gather from the testimony of the gentlemen who presented their testimony before the committee this morning, your great need is qualified teachers. It is not for building facilities, it is not for equipment, it is not for schools, but it is for qualified teachers. Is that correct?

Mr. LINDVALL. Yes, sir. We may not be good empire builders in saying so but this is our firm belief.

Mr. MORGEN. One point I would like to add. We are not saying facilities are not needed. However, if you get good staff, even with a string and a piece of wire you can do something. With all the beautiful equipment in the world and no staff you can do nothing.

Mr. BUSH. In other words, the building facilities that you have today, if you had enough qualified teachers, would be sufficient and you could turn out a better prepared student?

Mr. LINDVALL. Certainly better ones.

Mr. MORGEN. We are not minimizing the facilities. Do not misunderstand us. They are needed.

Mr. HAZEN. It is a case somewhat of the cart and the horse, I believe. We make no guaranty that as we build up these faculties, and these faculties are live people with good ideas, that there will not be requests for additional facilities and buildings. I am betting there will be.

However, unless you get the first-class faculty in sufficient numbers, buildings and facilities are of no use, and if you get first-class faculties the pressure for buildings will come when the time is ripe.

Mr. NEAL. I have no questions and no comment.

Mr. LOSER. What will we do with the medical schools and teachers in the other sciences when they hear about this very fine presentation which the engineers have made with reference to increases in salaries for teachers? Would we not be besieged by these other groups in the other sciences for the same type of aid?

Mr. MORGEN. I can speak for my own institution and several others. In the department of chemistry it can be said that any staff member who wants to do research in the summer now can get research support. I have not had to turn down a single chemistry professor in the last few years.

We have not had sufficient funds in the engineering fields.

Mr. HAZEN. The law of supply and demand operates here as it does everywhere else. It works particularly acutely on the engineers. I think it also works on the business schools. In the medical schools, according to what I hear—our institution does not have one—the salaries of the first rate full-time medical people are way up.

They make us engineers look like pikers.

I think, on the other hand, that being in a competitive field which pushes salaries up in engineering, we must look with sympathy upon our friends in the humanities where there are these strong competitive forces and should lend our moral support to seeing that those people achieve reasonable salary levels as well as in engineering. We owe this to the profession.

Mr. LOSER. I thoroughly agree with you.

Mr. DINGELL. I would be pleased to hear answers to these questions from any member of the panel now before us.

I was wondering about this statement: We do not need more students in these fields. Is that from a school point of view or a national point of view, or just what would be the fairest way of cataloging that statement?

Mr. LINDVALL. Our feeling is that no additional incentives are needed to get more students to come into engineering, because the general growth of population and the fraction of students normally entering engineering will give an increase which will come along faster than we can take care of them.

Mr. DINGELL. Should faculty positions be competitive salarywise for engineers?

Mr. HAZEN. We have tried to make this distinction very clear in our report discussing this whole situation. It seems to us that the vital point is that the opportunity, all aspects considered, the total satisfaction package associated with a faculty position, should be competitive with the corresponding total satisfaction package for any other career for a reasonable fraction of the first rate minds interested in engineering.

I think there is evidence to indicate that this equal satisfaction, competitiveness so far as the position is concerned, does not require as large a salary in the academic scene as is required in industry.

There are many aspects of the academic life which are valued rather highly by those who are in academic life, and academic people are willing to accept these in lieu of a certain part of a salary, so the salaries do not have to be competitive in an arithmetic sense.

However, the test is this: When we go out for a leading mind to serve in a faculty, we feel that we should be successful in a reasonable fraction of the bids in attracting precisely the fellow that we need to do a good job.

Mr. DINGELL. I would like to ask another question, if I may, gentlemen. Would you tell us to what extent industry contributes to the support of schools of engineering and to the support of projects of schools of engineering?

Mr. MORGEN. Gentlemen, I can answer that. Our institution is typical, and I am talking now about support of graduate research, which is the only way we can measure it. Nationwide the support is about 70 percent from the Federal Government, 20 percent from industry, and 10 percent from the university's own funds. That is about the national picture.

Mr. DINGELL. Do you think this industry contribution could or should be increased?

Mr. MORGEN. I think it would be highly desirable, and the probability is that it would take some tax incentive to both industry and private donors.

Mr. DINGELL. I assume, gentlemen, that you are speaking as officers of private schools rather than officers of State institutions.

Mr. MORGEN. I am with a State institution. Here is a private institution and another private institution.

Mr. DINGELL. Is there a difference, then, in the problems faced by private institutions as contrasted to, let us say, State and municipally supported schools?

Mr. MORGEN. There is a difference, but only in degree. The State and tax-supported institutions get very little support from graduate programs. They get support from undergraduate programs from the State. Traditionally the graduate programs have been supported by either "bootleg" funds or outside support.

Mr. DINGELL. Would you tell us what the "bootleg" funds of a university are?

Mr. MORGEN. The teaching load of a professor is reduced so he can do research. His whole salary comes from the State. Actually he is doing research. The money was appropriated for him to teach.

Mr. DINGELL. Would either of the other two gentlemen care to comment on that?

Mr. LINDVALL. The problems a private school faces in these days of rising costs is that of soliciting additional funds. To a certain extent a publicly supported institution does have tax power which private schools do not have. So to a considerable extent the private schools have tended to lag behind the State-supported schools, although that is not a complete picture by any means.

There are outstanding examples of salary scales in private institutions and there are some woefully poor ones, also. You find similar spreads in the State universities. My own institution, for example, has a difficult time competing, salarywise, with the University of California.

Mr. DINGELL. Would you like to comment, Dr. Hazen?

Mr. HAZEN. I think the points have been covered very well here. I will offer one comment, however, sir.

As Dean Lindvall has pointed out, the private institutions do have to seek additional moneys both to counter the general inflation effects which depreciate the value of their endowments and to take care of the inevitable increases in size as the population increases produce admissions pressures on our institutions.

The private institutions run the whole gamut from those which are extremely vigorous and say they must have the money and take whatever steps are necessary to get it, which takes real doing, to some of the smaller ones which, conscientious, good, and thorough though they may be, simply do not seem to have the dynamics to get out and get the money to raise their full professors' salaries above $5,000 or $6,000 a year.

All three of us have been in the ECPD accrediting activity vigorously, and it is painful to go to some of the both private and some State institutions and see the terribly depressed level of the salary scale and all which follows logcially from that.

Vigorous, dynamic leadership is every bit as important in the field of engineering education as it is in any other activity in this world.

Mr. MORGEN. I would like to add one point which I think might be important to the committee, and that is, there is a very definite correlation, going around the country, between those departments which are doing research and those which are not. Therefore, the mechanism of increasing the amount of funds available for research will do as much to raise the academic level as anything else. The two are tied together nationally.

Mr. DINGELL. Let me skip, then, to one more point. Would I be fair in saying that the position which generally has been announced by you gentlemen this morning is that you are satisfied that the National Science Foundation has adequate authority to do most of the things you feel are necessary for schools of engineering, at least insofar as the Federal Government can and should participate. The problem which you face at the present time and which the National Science Foundation faces in carrying out the legislative authority and responsibility which it has is the lack of appropriations to carry forward the program? Is that correct?

Mr. MORGEN. I would like to put it a little differently. I think the total appropriation may be all right, but the Congress somehow or other circumscribes those funds in such a way that they might have to do certain things which are not so desirable because of the way the money is pocketed.

So if increased funds were available, first, specifically mentioning assistance to engineering programs and, secondly, to research and the support of graduate students as opposed to other things, that would solve the problem.

Mr. DINGELL. What you are urging is a different form of earmarking of existing appropriations.

Mr. MORGEN. That is correct, sir. I am talking now about the full bill which was presented. I do not remember what condition it is in now.

Mr. DINGELL. A substantial reduction was made, as I understand it.

Mr. MORGEN. I am talking about the amount of approximately $40 million as recommended.

Mr. DINGELL. I believe that figure has been substantially reduced.

I think you admit there is room for considerable difference of opinion as to where the emphasis should be placed. You folks generally tend to speak of the applied sciences as contrasted to basic research. Is that a fair statement?

Mr. MORGEN. I always object to the words "applied" and "basic." I would like to say the kind of research which a student does for his thesis in engineering would be considered by a physical professor as applied on an engineering basis. That is where the real argument comes in. We get into semantics. We can tell the exact number of graduate students we need in engineering and the number of professors we need. If that amount of money were earmarked for engineering research, we know what could be done within the limits of other appropriated funds, and that would solve the problem.

Mr. LOSER. What is that sum?

Mr. MORGEN. I would say approximately $40 million.

Mr. LOSER. Annually?

Mr. MORGEN. That is right.

Mr. HAZEN. May I comment on that?

As Dean Morgen says, what the engineer may consider as fundamental research in his field may be looked upon in many cases, not all cases, as applied, by the scientist. Nevertheless, the engineer has in his field what he calls applied research which is likely to be that directed toward developing specific hardware for the armed services, for example. If a pilot model at least to demonstrate a principle is required, the engineer is likely to call this applied research. An inquiry into the fundamental considerations underlying a particular part of the engineering field, developing new fundamental concepts in structures, a new understanding of the field of structures designed to resist blast or earthquakes or something of that sort, he would call pure or fundamental research in engineering, whereas the means of achieving or expressing that better understanding in terms of specific design of structures the engineer would call applied research.

Mr. DINGELL. I should like to ask one last question here, if I may.

Would you have any objection to perhaps an authorization to the National Science Foundation to accept contributions to be used for the purposes which you have set forth this morning?

Mr. MORGEN. That is already in the National Science Foundation charter.

Mr. DINGELL. That authority is in the National Science Foundation?

Mr. MORGEN. That is right. So far they have been unsuccessful. I happen to have been the first program director for engineering sciences of the National Science Foundation in 1952 to 1954, and we tried very hard to get donations for that and were not successful because industry preferred to give direct and have the advertising value. I do not say it is not possible. It just did not work.

Mr. BUSH. Your presentation this morning related to public programs bearing on engineering. I would like to know if it applies only to State and private institutions in engineering?

Mr. LINDVALL. When you speak of the State and private colleges of engineers, you have named them all, with the exception of some which might be municipally supported. There are no proprietary

engineering schools of any consequence which attempt to give baccalaureate work.

Mr. DINGELL. Any further questions?

Gentlemen, in behalf of myself and the other members of the committee, we certainly wish to compliment you for your very fine presentation. It has been an honor to hear you.

Mr. LINDVALL. Thank you very much, sir.

Mr. DINGELL. Are there any other witnesses present this morning to be heard? (No response.)

Then the committee will stand adjourned subject to the call of the Chair.

(Whereupon, at 12:05 p. m., the subcommittee adjourned, subject to call of the Chair.)

NATIONAL SCIENCE FOUNDATION

THURSDAY, JULY 24, 1958

HOUSE OF REPRESENTATIVES,
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE,
SUBCOMMITTEE ON SCIENCE AND HEALTH,
Washington, D. C.

The subcommittee met at 10 a. m., in room 1324, New House Office Building, Washington, D. C., the Honorable John Bell Williams (chairman of the subcommittee) presiding.

Mr. WILLIAMS. This morning the Subcommittee on Health and Science is continuing its hearings begun earlier this session on bills relating to the National Science Foundation, basic research, and science education.

In our earlier hearings one of the bills on which we are holding hearings this morning had not been introduced. This is H. R. 13091, introduced by the chairman of the full committee, Mr. Harris, at the request of the National Science Foundation.

(H. R. 13091 and reports thereon are as follows:)

[H. R. 13091, 85th Cong., 2d sess.]

A BILL To authorize the expenditure of funds through grants for support of scientific research and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the head of each agency of the Federal Government, engaged in making contracts for basic scientific research at institutions of higher education or other nonprofit organizations, is hereby authorized, where it is deemed to be in furtherance of the objectives of the agency, to make grants to such institutions or organizations for the support of such basic scientific research.

SEC. 2. Authority to make such grants, or to make contracts for the conduct of basic or applied scientific research at institutions of higher education or other nonprofit organizations, shall include discretionary authority, where it is deemed to be in furtherance of the objectives of the agency, to vest in such institutions or organizations, without further obligation to the Government, or on such other terms and conditions as the agency deems appropriate, title to equipment purchased with such grant or contract funds.

THE SECRETARY OF COMMERCE,
Washington, D. C., August 6, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, Washington, D. C.

DEAR MR. CHAIRMAN: This letter is in reply to your request of July 8, 1958, for the views of this Department with respect to H. R. 13091, a bill to authorize the expenditure of funds through grants for support of scientific research and for other purposes.

We favor enactment of H. R. 13091.

This bill would permit agencies of the Federal Government to make grants as well as contracts for basic scientific research conducted for them by institutions

of higher education or other nonprofit organizations. The bill would also allow Government agencies to vest title to equipment purchased for such research in the research institutions.

We believe that enactment of this bill would lead to improvement in the results obtained from basic research by giving the researcher greater freedom in his work and by simplifying the administration of such research. The provision permitting title to equipment to be vested in the research institution doing specific research for Government agencies would lead to more economical administration of sponsored research.

The provisions of this bill would be of considerable help to the scientific agencies of the Department of Commerce, and, accordingly, we support its enactment.

The Bureau of the Budget has advised that it would interpose no objection to the submission of this letter.

Sincerely yours,

SINCLAIR WEEKS,
Secretary of Commerce.

DEPARTMENT OF THE AIR FORCE,
OFFICE OF THE SECRETARY,
Washington, August 1, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives.

DEAR MR. CHAIRMAN: The responsibility for answering your request to the Secretary of Defense for the views of the Department of Defense on H. R. 13091, 85th Congress, a bill to authorize the expenditure of funds through grants for support of scientific research and for other purposes, has been assigned to this Department.

On behalf of the Department of Defense, the Department of the Air Force concurs in the purpose of H. R. 13091 which will permit the head of any agency of the Federal Government, engaged in making contracts for basic scientific research, to authorize grants for the support of scientific research at institutions of higher education or at other nonprofit organizations. At present, this authority is held only by the Department of Agriculture, Department of Health, Education, and Welfare, the Atomic Energy Commission, and the National Science Foundation. The Department of Defense believes that a more liberal attitude in authorizing grants for the support of basic research and for the vesting of title to research equipment would greatly stimulate and enhance basic research efforts in this country.

Passage of this legislation will result in no additional cost to the Department of Defense.

This report has been coordinated within the Department of Defense in accordance with procedures prescribed by the Secretary of Defense.

The Bureau of the Budget has advised that there is no objection to the submission of this report to the Congress.

Sincerely yours,

JAMES H. DOUGLAS.

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D. C., July 14, 1958.

Hon. OREN HARRIS,
Chairman, Committee on Interstate and Foreign Commerce,
House of Representatives, House Office Building, Washington, D. C.

MY DEAR MR. CHAIRMAN: This will acknowledge your request for the views of the Bureau of the Budget on H. R. 13091, a bill to authorize the expenditure of funds through grants for support of scientific research and for other purposes.

H. R. 13091 is identical with the draft bill which the National Science Foundation submitted to the Congress following clearance by the Bureau of the Budget.

The Bureau believes that the enactment of H. R. 13091 would benefit the management of research programs in the Federal agencies and would also benefit relations between the Government and universities in the conduct of research under Federal sponsorship. Accordingly, the Bureau would have no objection to enactment of H. R. 13091.

Sincerely yours,

PHILLIP S. HUGHES,
Assistant Director for Legislative Reference.

Mr. WILLIAMS. The purpose of this bill will be explained by the witnesses this morning. It is my understanding that this legislation has the support of the departments and agencies represented by these witnesses. After we have completed hearing the testimony on H. R. 13091, we shall hear further testimony from Dr. Waterman on H. R. 11257.

Dr. Waterman, I believe, is our first witness this morning. Welcome back to the committee, Doctor. I believe you in your statement outline the purposes of H. R. 13091.

Since the House meets at 11 o'clock this morning instead of the usual hour of 12, the committee will ask that the witnesses be as brief as possible in order that we can complete the hearings this morning if it is at all possible. Perhaps it would be best if those who are willing to do so submit prepared statements for insertion in the record where they will appear as if read and permit the witnesses to explain briefly their statements. We will let the text of the statement go into the record and in order to save time we would like for those who are willing to do so to outline briefly what is in their statement. Perhaps your statement, which I notice is rather brief, might be read in its entirety.

STATEMENT OF ALAN T. WATERMAN, DIRECTOR, NATIONAL SCIENCE FOUNDATION

Mr. WATERMAN. Mr. Chairman and members of the committee, I appreciate the opportunity to give you the Foundation's views on H. R. 13091, which would authorize agencies of the Federal Government, engaged in making contracts for basic scientific research at institutions of higher education or other nonprofit organizations, to make grants for support of such basic scientific research and would authorize such agencies to vest in such institutions or organizations, without further obligation to the Government, title to equipment purchased with grant or contract funds provided for the support or conduct of basic or applied research.

This legislative proposal has been presented by the Foundation in accordance with its statutory authority to encourage the pursuit of national policies for the promotion of basic research and education in the sciences. The Foundation already possesses the authority which would be provided by this bill. However, we believe that authority to use the grant mechanism and to fully dispose of property purchased with research funds provided by the Federal Government, would be of great assistance to other agencies concerned with scientific research activities. The use of the contract form is obviously in

order where the agency desires to engage the services of an educational or nonprofit organization for the conduct of a specific piece of research for the agency directed toward a specific purpose. However, where an agency desires to stimulate and support fundamental research in a given field of interest to the agency, with the range of the inquiry limited only by the curiosity and creativity of the scientific investigator, use of the grant mechanism has several advantages:

1. Psychologically, it is more in keeping with the concept of maximum freedom for scientific investigation.
2. It is not necessary to adapt hardware procurement regulations to the support of the research; and
3. Necessary advance payments can more readily be made.

In connection with grants, it is always the interest of agencies concerned with scientific research to provide support to high-quality research in the national interest. It is the quality of research which is uppermost here.

The matter of title to equipment provided in connection with research activities has been a difficult one. It is our view that, at times, the national interest can best be served if the Government does not retain title to such equipment. Recordkeeping and warehouse storage can be minimized and, in addition, more productive use can frequently be made of such equipment by leaving it with the educational or nonprofit institution or organization rather than having it returned to the Federal Government.

The authority granted by this bill would be permissive in nature, and it would be up to the individual agency to exercise its discretion with regard to whether it uses the grant or the contract procedure and with regard to whether it retains title to equipment purchased under the contract or grant. Greater flexibility could be attained but the Government's interest would still be well protected.

I should like to emphasize that the provisions of this bill would not authorize any new research programs or activities nor would it increase Federal expenditures in any way. In fact, in my considered judgment, it should serve to reduce the administrative paperwork incident to the support of research at colleges and universities as well as to strengthen greatly the basis of Government-university relationships in the conduct of federally sponsored research.

Thank you, Mr. Chairman. I shall be glad to answer any questions I can.

Mr. WILLIAMS. Thank you very much, Doctor.

I believe you mentioned somewhere in your statement that you already have the authority to do what is provided by this bill.

Mr. WATERMAN. We do. However, we believe it would be in the Government interest to have the same authority in the hands of other agencies. They have similar problems to ours.

Mr. WILLIAMS. In other words, the Science Foundation already has this authority but you are asking that this authority be given to other agencies of Government which are engaged in making contracts for basic and scientific research?

Mr. WATERMAN. Yes, to support research at nonprofit institutions.

Mr. WILLIAMS. Such as the Navy or the military services and others?

Mr. WATERMAN. That is correct. This concerns chiefly the Department of Defense and Atomic Energy Commission because they have large programs of this sort, but are limited to the use of contracts.

Mr. WILLIAMS. Would this go so far as to cover a case of this nature: Some group is conducting research into sociological problems and in doing so they have to use IBM equipment. Would this authorize the Government to grant these institutions that IBM equipment?

Mr. WATERMAN. The common thing is to lease the IBM equipment, but if it were purchased by the Government, the Government would have the option of retaining it or turning it over to the institution for permanent use.

Mr. WILLIAMS. The bill refers to "nonprofit organization." What nonprofit organizations can come under this program?

Mr. WATERMAN. Any organization like Battelle Memorial Institute which does research in a nonprofit way. There are a number of private nonprofit institutions that are not educational of that general category.

Very frequently, Mr. Chairman, it occurs that in basic research a rather complicated system of equipment is constructed on the spot, which is somewhat costly, but adapted for a particular purpose. Even if one wanted to move it somewhere else the cost would be almost prohibitive for assembling the thing again.

Mr. WILLIAMS. Assume, for instance, that the American Federation of Labor, should be conducting a research study of some kind into, we will say, socioeconomic matters. Is that type of thing considered to come within this program?

Mr. WATERMAN. If it were scientific research, not economic. The criterion here is science. The equipment is, generally speaking, either for the pyhsical sciences or biological sciences where they must have physical equipment specifically adapted to their needs.

Mr. WILLIAMS. It is intended to be restricted to the physical or biological sciences?

Mr. WATERMAN. That would be by far the largest use of it. There might be some in the social sciences but those would be the scientific side of social sciences entirely. Certainly there would be some experimental equipment in psychology. That would be on the borderline. Other agencies that handle these things might have some other answers.

Mr. WILLIAMS. I am certain it is the intention of the Science Foundation to restrict these grants to these nonprofit organizations and to transfer this property to those nonprofit organizations whose primary purpose is scientific research.

Mr. WATERMAN. That is right.

Mr. WILLIAMS. That is not spelled out in the bill. What would your feeling be about restricting this bill to those nonprofit organizations which are engaged primarily in scientific research?

Mr. WATERMAN. I think a qualifying clause that this shall apply to equipment for scientific research would be useful and valuable but I would not want to imply that a university is dedicated primarily to scientific research. This provision would apply to the scientific research done by the institution.

Mr. WILLIAMS. I understand universities are included in this category and, in addition to that, you have your so-called nonprofit organizations.

Mr. WATERMAN. Yes.

Mr. WILLIAMS. I am inclined to feel the language would take care of your universities and institutions of higher learning, but when we

bring in nonprofit organizations, to be very honest and frank with you, I begin to look a little askance at legislation, because I know that that can open the door to areas that are not even contemplated by the Science Foundation or anyone else in drafting this legislation. I am wondering how we might restrict that in order to confine it to fields of scientific research, exclusively.

Mr. WATERMAN. I see your point. I think that would work out all right if it is agreeable to the other agencies. I think it is a good point.

Mr. WILLIAMS. I am wondering if the Foundation might in the next several days put their men to work on some suggested language to take care of that situation, and to confine the bill to the purposes of physiological or physical and biological research, as it is intended here, and possibly these other areas; but be sure to limit them to the scope intended by the bill.

Mr. WATERMAN. Very well.

Mr. WILLIAMS. Are there any questions, Mr. Neal?

Mr. NEAL. I presume that in negotiating contracts with various nonprofit institutions you have in the past been required to purchase for these organizations a good bit of equipment.

Mr. WATERMAN. Actually I think our figures are that of the total cost of our research support program in the NSF, just a little less than 9 percent goes for equipment, physical equipment.

Mr. NEAL. The sole purpose of this bill or your objective as I understand it is to free the Government of ownership, and transfer this to the local organization to avoid record keeping and housekeeping and all that sort of thing.

Mr. WATERMAN. That is part of it. The first is the authority to make grants as well as contracts. The second is, provided equipment is purchased or constructed with funds provided by the grant, then the right for the Government to either hold it or give it to the nonprofit institution if they see fit.

Mr. NEAL. I think with the limitation suggested by the chairman of the committee, Mr. Williams, that it would appear to be a reasonable request.

Mr. WATERMAN. That is a good point, sir.

Mr. NEAL. Thank you.

Mr. WILLIAMS. Mr. Bush?

Mr. BUSH. Dr. Waterman, you say the matter of title to equipment provided in connection with research activities has been a difficut one. If it is your view that at times the national interest can best be served if the Government does not retain title to such equipment, who does retain title to it?

Mr. WATERMAN. You mean in the past?

Mr. BUSH. Now or in the past.

Mr. WATERMAN. In the past we have had the authority to grant title to the nonprofit institution. Other agencies have not had this generally. If not, it has to be kept on the books in some way by the agency even though the equipment may be built in and stay there for years. One has to keep account of it or else it has to be disposed of somehow by purchase, which can be a very troublesome thing to determine. It is just a very awkward piece of paperwork. The Government very often never finds any use for it except at that institution and the best use is in the institution's hands.

Mr. BUSH. Who does retain the title to it?

Mr. WATERMAN. The Government in that case.

Mr. BUSH. The Government?

Mr. WATERMAN. In that case, yes.

Mr. BUSH. I would certainly think the Government would retain title, but you say it does not in your statement.

Mr. WATERMAN. I say we have authority in the Foundation to grant title to the institution. In that case the Government would not retain title but in the case of most agencies the Government does retain title which means keeping it on the books indefinitely.

Mr. BUSH. I can see where it would be very helpful as far as your records and all the paperwork involved to keep track of all this equipment, are concerned. Thank you.

Mr. WILLIAMS. This is a hypothetical case in point: At Mississippi State College, the Department of Aerophysics, Dr. Raspet, a very close friend of mine, is conducting experiments under contract with one of the services, I think the Navy Department. He is conducting experiments and doing research work into boundary layer control. Those who know about aviation know what that is.

In doing so he uses both gliders and light aircraft, all of which belong to the Government.

In the case of the gliders it is quite likely that the Government has no need for these sail planes other than for the purposes of the research being done at Mississippi State College. In the case of the small liaison aircraft in all probability the Government would have further use for those.

Is it the purpose of this bill to make it possible for the Government to make an outright grant to the department of aerophysics at Mississippi State College of the gliders when they are through using them, but to recapture, we will say, or recall the aircraft which are of some use to the military service? It may be that the gliders are of use, I do not know. Is that the type of case you refer to?

Mr. WATERMAN. Yes. Mr. Chairman. If the Government has use for the equipment they will retain title and of course could order it somewhere else, but if the Government has no use for it it would be a way of getting it off the books and into a place where it would continue to be useful.

Mr. WILLIAMS. That appears to be a very reasonable approach.

Mr. NEAL. The purpose of your bill is to make it purely optional for the Department to do this?

Mr. WATERMAN. The Government always has control of what happens. It would not be mandatory.

Mr. NEAL. Do you find you frequently have occasion to annul contracts that you make with various agencies for research because of improper attention or lack of proper application to the objective?

Mr. WATERMAN. That is extremely rare. I do not know what a canvass of the grant-contract situation would indicate. It is rare that a contract would be terminated for that reason, because on the whole the nonprofit institution knows how to make progress and they do it. They have competent men or the grant would never have been given.

Sometimes the research runs into a stone wall and, being basic research, they cannot be sure how it will pan out. If the line they are taking seems to run out and not be successful, then the agency steps in and says, You will not need the rest of this money. This is discussed

and either the research has to take a turn in another direction which looks profitable or else the grant is cut back.

This is always possible. Every grant or contract has this authority so far as I am aware.

Mr. NEAL. Thank you.

Mr. WILLIAMS. There is no purpose in this bill to provide a means of subsidizing these institutions, is there?

Mr. WATERMAN. No, indeed.

Mr. WILLIAMS. That is not even an indirect purpose of the bill?

Mr. WATERMAN. No, indeed. In every case I think in this whole program of basic research the idea is to strengthen the basic research efforts of the country. In every agency it is reviewed very carefully to determine competence and experience of the group and the promise of work. Every agency is quite selective. It cannot handle all requests. This is a national effort of some proportions, a very valuable one.

Mr. WILLIAMS. I mentioned IBM machines. In the case of electrical equipment of that nature where the Government has a need for that type of electrical equipment, it would not be donated to these groups?

Mr. WATERMAN. That is correct.

Mr. WILLIAMS. It is only in the case where the Government deems that its use for that equipment is so slight that it would actually cost the Government less to give it to these people than to have to keep it on its books and inventory?

Mr. WATERMAN. That is correct. It would be done based on the national interest.

Mr. WILLIAMS. Are there any further questions?

Mr. BUSH. Do you have much equipment in warehouse storage?

Mr. WATERMAN. The National Science Foundation does not. The Department of Defense has a good deal of it, but we do not have it at all.

Mr. WILLIAMS. Would you like to go into H. R. 11257 now or would you prefer we hear from other witnesses this morning? We have only 30 minutes more.

Mr. WATERMAN. Just as you like. I should think if the others submit statements, you might wish to ask questions.

Mr. WILLIAMS. H. R. 11257, I notice, is a rather lengthy bill, and apparently will require a great deal of explanation in addition to that already received by the committee.

Mr. WATERMAN. It is largely a matter of clarification.

Mr. WILLIAMS. In view of the time limitation, I would think, subject to the will of the committee, that we probably should confine our hearing this morning to H. R. 13091, and attempt to set another day of hearing for H. R. 11257.

Mr. WATERMAN. Your plan is quite acceptable to me, Mr. Chairman.

Mr. WILLIAMS. I personally have no objection to H. R. 13091, provided it is sufficiently restricted to carry out the purposes for which it has been drawn and which you have explained here.

It is your feeling that it is sufficiently restrictive for that?

Mr. WATERMAN. With your proposed modification, I think this would make it completely clear.

Mr. WILLIAMS. I do not have the language with which to modify it.

Mr. WATERMAN. We will go into that as you suggested.

Mr. WILLIAMS. We will be glad to have you submit a suggested amendment to carry out that purpose, if you will.

Mr. WATERMAN. Very well.

Mr. WILLIAMS. You might go briefly into H. R. 11257. Mr. Borchardt tells me that the other witnesses here are willing to file their statements on H. R. 13091, which is a very simple bill. It might be possible for us to wind up this morning if you want to go into H. R. 11257 now. However, perhaps we had better call these witnesses as they are listed here.

Dr. Stanley Fracker, assistant to the Administrator, Agricultural Research Service, Department of Agriculture.

STATEMENT OF STANLEY B. FRACKER, ASSISTANT TO THE ADMINISTRATOR, AGRICULTURAL RESEARCH SERVICE, DEPARTMENT OF AGRICULTURE

Mr. FRACKER. The general purpose and handling of operations under this bill has been discussed by Dr. Waterman. It is unnecessary for me to go into that. I do not have a prepared statement, but in a minute or two I can explain how this bill would affect the Department of Agriculture.

The Department has the authority and responsibility of administering certain grants at the present time. Those grants are statutory in which the amount supplied to each grantee is designated by law and it is carried in the appropriations bills and designated by Congress.

The Department also has authority to engage in contract research where such contract can be handled to the advantage of the Government, either more cheaply, more efficiently, or more rapidly.

At present the Department does not have authority to issue grants, discretionary grants, where the institution is designated. This would be helpful, this authority would be helpful in the case of basic research particularly. The Department engages in contract research to only a limited extent, something of the order of $2 million a year.

In a number of cases it has found that where we would like to have an educational or nonprofit organization do a certain piece of basis research, it is very difficult to put that into a contract form because of the difficulty of telling in advance precisely what it is that the agency is expected to report on. It would be helpful in the work of the Department if such cases could be handled through the grant mechanism rather than the contract mechanism, which is governed by procurement regulations.

I think that about covers the interest of the Department. I might say we are also supporting section 2 for the same reasons that the National Science Foundation supported it. In a number of cases it is to the advantage of the Government to leave title to equipment purchased under grants or contracts with the grantee because it would cost the Government more to make disposition of that equipment at the end of the contract or grant period.

Mr. WILLIAMS. Do I understand you do not now have authority to do that which Dr. Waterman apparently does?

Mr. FRACKER. We do not have authority to do that in the case of our contracts and we have no authority to make discretionary grants. The property purchased on the statutory grants to the State experiment stations belongs to the experiment stations. That situation is not involved in this legislation in any way.

Mr. WILLIAMS. Could you give us an example of an instance where this law would be applied in the case of the Department of Agriculture? Just a hypothetical case, not a specific case.

Mr. FRACKER. Where we have information that particularly high-grade work is being done in some such problem as the physics of soils, soil structure, or the physiology of a plant or animal, we would sometimes feel it advantageous to the Department to have them go ahead along some different line or to support the work that they are doing in this particular field to a limited extent, perhaps by purchasing equipment they otherwise cannot afford and that sort of thing, perhaps employing one or two more assistants.

It is difficult to handle such a case under the contract mechanism because it is hard to tell just what they may come up with, but it does involve instances where it is quite helpful to the work of the Department to have these people go ahead in fields of this type. It is that class of situation which we would like to have this bill to enable us to handle.

Mr. WILLIAMS. Do you agree with Dr. Waterman's statement to the effect that in the long run this will not result in any additional cost to the Government in connection with these programs?

Mr. FRACKER. That is correct.

Mr. WILLIAMS. Mr. Rhodes?

Mr. RHODES. No questions.

Mr. WILLIAMS. Mr. Neal.

Mr. NEAL. I believe you say the Department of Agriculture does now have the same authority to purchase and supply these contracting agencies with necessary equipment; is that right?

Mr. FRACKER. I did not get the question. Did you say does now have or does not have?

Mr. NEAL. Do you now have the same authority that exists with the National Science Foundation to furnish equipment to these agencies with whom you contract?

Mr. FRACKER. We can enable and authorize the contractor to purchase equipment. Under present circumstances we do not have the right to tell the contractor that he may keep the equipment.

Mr. NEAL. If you make a contract through your agency to do a certain job and authorize him to purchase the equipment, does that equipment go into the possession of the organization doing the research work or does it still remain in the possession of the Agriculture Department?

Mr. FRACKER. At present it remains in the possession of the Agriculture Department unless there is some provisions in the contract under which it is amortized during the period of the contract. Those would be cases where we felt the equipment would not be of value at the end of the period. We would find it advantageous to have the authority that is given in this bill in such cases.

Mr. NEAL. The objective of your Department is practically the same as the objective of the National Science Foundation.

Mr. FRACKER. That is right.

Mr. NEAL. Thank you.

Mr. WILLIAMS. Mr. Bush?

Mr. BUSH. No questions.

Mr. WILLIAMS. Thank you very much, Dr. Fracker.

Mr. Ben Huff is Director of Review and Service, Office of Assistant Secretary of Defense for Research and Engineering. Do you have a prepared statement?

STATEMENT OF BEN G. HUFF, DIRECTOR OF REVIEW AND SERVICE, OFFICE OF ASSISTANT SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

Mr. HUFF. Yes; I will not read it. I will simply say that the Department of Defense wholeheartedly supports this bill and we support the statement of Dr. Waterman he made this morning as well as the answers he made to the questions asked of him by this committee.

I might point out one advantage that he did not mention. Leaving this equipment with institutions like Mississippi State, some instrumentation which is built in, rather than have the Government retain title and go through the exercise of getting it back, disposing of it, tearing it out, and so on, if we leave it with the institution they can make use of it in the educational program they have with students coming down the line. I think this is in the national interest. Perhaps later the Government could go back and get additional use out of it.

Mr. WILLIAMS. I mentioned that case because I am probably more familiar with that particular case than I am any other. I thought probably it was a case in point.

Mr. HUFF. It certainly is. As it is now, the Navy would have to take back both the gliders and the aircraft, whether they had any use for them or not.

Mr. WILLIAMS. We would assume they had no use for the gliders. If they did have use for the gliders, they would take them, too, of course.

Are there any questions? Thank you very much. We will be glad to insert your statement in the record.

(Mr. Huff's prepared statement follows:)

STATEMENT OF MR. BEN G. HUFF, DIRECTOR OF OFFICE OF REVIEW AND SERVICES, OASD (RESEARCH AND ENGINEERING), ON H. R. 13091

Mr. Chairman and members of the committee, I am Ben G. Huff, Director of the Office of Review and Services, Office of the Assistant Secretary of Defense (Research and Engineering).

I appreciate this opportunity to meet with you and to comment on the bill which would authorize agencies of the Federal Government to make grants and to vest title to equipment purchased with such funds to the organizations performing basic research.

The bill would make it possible for the Department of Defense to make grants to universities and nonprofit organizations as well as contracts which we are confined to by present legislative authority. The proposal has the advantage to the Department of Defense of reducing the bookkeeping operations and accounting procedures for university and nonprofit research. At the same time, the proposed procedure would reduce the bookeeping and accounting required of the organizations performing the research and would provide them with funds in advance of the performance of the work, which is a very desirable feature.

Furthermore, the section of the bill permitting such organizations to hold title to equipment purchased with grant and contract funds, used to support basic or applied scientific research, would eliminate the time, labor, and expense involved in keeping records of equipment and negotiations at the time of termination of such projects. In addition, this procedure would have the advantage of leaving the equipment with the institutions for use in later research from which the Government may expect future benefits.

In conclusion, I would like to say that the Department of Defense wholeheartedly supports the proposed legislation as we indicated in testimony on the similar Senate bill 4039, in testimony before the Subcommittee of the Senate Committee on Government Operations on June 25, 1958.

Mr. WILLIAMS. Dr. Charles Shilling is with the Atomic Energy Commission, Deputy Director of the Division of Biology and Medicine.

STATEMENT OF DR. CHARLES W. SHILLING, DEPUTY DIRECTOR, DIVISION OF BIOLOGY AND MEDICINE, ATOMIC ENERGY COMMISSION

Dr. SHILLING. I have a prepared statement, sir, and have nothing to add except to express our wholehearted support for both parts of the bill.

Mr. WILLIAMS. I assume this is a problem common to all these agencies conducting research.

Dr. SHILLING. This is correct, sir.

Mr. WILIAMS. Is it your feeling as Dr. Waterman has expressed that this will not add to the cost of your program?

Dr. SHILLING. I agree with him completely that it will not add to the cost of the program and, as a matter of fact, I believe we can look to some saving in the administrative aspects of our research program.

Mr. WILLIAMS. You think the saving that would result from the elimination of paperwork, we will say, would more than offset the cost of the equipment which is donated?

Dr. SHILLING. I think so, sir. We would not of course contemplate donating, as you say, equipment which could be used in other locations.

Mr. WILLIAMS. Are there any questions?

Mr. BUSH. This bill makes it possible for more flexible use without a lot of red tape?

Dr. SHILLING. This is correct, sir.

Mr. WILLIAMS. The Atomic Energy Commission deals with some pretty expensive equipment.

Dr. SHILLING. That is right, sir.

Mr. WILLIAMS. Even so, it is still your feeling that this is not a costly program?

Dr. SHILLING. When you get into that type of thing you speak of, Mr. Chairman, I believe, we would be dealing with a contract anyway. We would use the grant and these privileges more for the basic research as the words of this bill indicate. There are other provisions for these massive pieces of equipment that are built at various places.

Mr. WILLIAMS. Thank you very much.

(Dr. Shilling's prepared statement follows:)

STATEMENT OF THE POSITION OF THE UNITED STATES ATOMIC ENERGY COMMISSION ON H. R. 13091

Presented on July 24 1958, to the Health and Science Subcommittee of the House Interstate and Foreign Commerce Committee by Dr. C. W. Shilling, Deputy Director, Division of Biology and Medicine, United States Atomic Energy Commission.

The Atomic Energy Commission lends wholehearted support to the concepts presented in H. R. 13091 which would authorize our agency to make grants as well as contracts for the support of basic scientific research in institutions of higher education and other nonprofit organizations.

The Atomic Energy Commission now has authority under existing law to make grants for the conduct of certain education and training activities. We are now utilizing this granting authority with educational and other nonprofit institutions in order to promote special education and training in the areas of primary interest to the Atomic Energy Commission. This granting authority has proven to be very beneficial from the administrative standpoint. Further, we believe that it has not only facilitated the handling of the educational activity but also has been a more economical operation.

This limited experience has led us to believe that similar advantages could be obtained from extending this authority to the area supporting basic scientific research. This would have a definite psychological advantage and would enhance the friendly relationship existing between the scientific community and the AEC. It would also avoid the detailed contract regulations which in many cases work a hardship since they are designed for procurement of specific items rather than for the support of fundamental research. Another distinct advantage would be the ability to make entire payment of the grant in advance rather than to require progress reports or other proof of work and to voucher the expenditures prior to payment.

However, we would like to stress the fact that the educational institutions would still have to meet prescribed requirements as to rigorous scientific standards, competency to perform the work, facilities for doing the research, etc. In other words, the selection of the individuals and the institutions to do the research would be based on the same standards now in force, with only the administrative requirements being changed. Because of its programmatic nature, much of the research sponsored by the AEC would probably continue to be handled by contract but much of the basic research portion of our program would be shifted to the grant method.

The Atomic Energy Commission also endorses the provisions of the bill which would permit us to allow our research contractors or grantees to retain title to scientific equipment purchased in order to conduct the research which we are sponsoring. The compelling reasons for favoring these provisions have been clearly set forth in the explanation of the draft bill and by the testimony of the National Science Foundation. We would find these provisions very helpful not only in connection with future grants or contracts, but also in enabling us to transfer some of the equipment used by the universities under contracts now in force.

Mr. WILLIAMS. Those were all the witnesses listed this morning. Are there others here on this bill?

(The following letter was submitted for the record:)

THE UNIVERSITY OF CHICAGO,
Chicago, Ill., July 25, 1958.

Hon. BARRATT O'HARA,
House of Representatives,
Washington, D. C.

MY DEAR MR. O'HARA: Your reports from Congress have been most informative and I certainly appreciate your sending them to me from time to time.

In line with economy, efficiency, and effectiveness, I should like to call your attention to a bill before the House, H. R. 13091, which was introduced by Representative Oren Harris, chairman of the Committee on Interstate and Foreign Commerce. This is a bill to authorize the expenditure of funds through grants (instead of contracts) for the support of scientific research, and other purposes. The various Air Force agencies that I visited while in Washington recently were highly favorable to the bill; as a matter of fact, it was they who brought it to my attention. As you know, various Government agencies have been supporting basic research at the various universities throughout the country. In principle, a contract calls for a highly detailed procedure for, and a narrowly defined goal of work that is to be executed under it. Research, on the other hand, is an adventure into the unknown and its goal can only be broadly defined. An attempt to sponsor research under a contract tends to distort it considerably so that it is no longer research but rather a technological development. With the exception of the National Science Foundation, the Department of Health, Education, and Welfare, and the Department of Agriculture, all other Government agencies have been writing contracts for basic research. Though the agencies themselves recognize the conflict between a contract and basic research and try to treat it somewhat as though it were a grant, they are held by the letter of the law from doing so. If they were forced to act in strict accordance with contractual procedures, then their efforts to support basic research would result in little scientific return.

This bill has the support of most of my scientific colleagues here as well as the administrative offices of the university. As yet I have found no opposition anywhere but I do fear that, in the rush for Congress to adjourn, the bill may not be called up for a vote. I hope that you will do as much as possible to get the bill on the floor of the House for discussion and a vote, before this term of Congress ends.

Sincerely,

ROBERT J. MOON,
Associate Professor of Physics.

Mr. WILLIAMS. Dr. Waterman, we have about 10 minutes or 15 minutes at the most before we will be called to the floor. I realize in that length of time your discussion of H. R. 11257 will probably have to be sketchy but we would like to have your views on it.

STATEMENT OF ALAN T. WATERMAN, DIRECTOR, NATIONAL SCIENCE FOUNDATION

Mr. WATERMAN. I have a prepared statement to submit.

(The statement follows:)

STATEMENT OF ALAN T. WATERMAN, DIRECTOR, NATIONAL SCIENCE FOUNDATION

Mr. Chairman and members of the committee, I am pleased to be given the opportunity to discuss H. R. 11257, legislation amending the National Science Foundation Act of 1950 which has been requested by the National Science Foundation.

The National Science Foundation Act of 1950 (Public Law 507, 81st Cong., 2d sess.) was approved on May 10, 1950. This act has generally proven well adapted to its mission. However, each passing year has emphasized our ultimate dependence on basic scientific research and the need for effective exchange of scientific information not only among scientists in this country but also with scientists abroad. It has, therefore, become desirable for the Foundation to request certain technical changes in the National Science Foundation Act in order to

promote greater efficiency of operation and to request increased authority to foster progress in science by furthering more intimate cooperation and communication between scientists of this country and those of other nations.

An example of the kind of technical change we believe to be needed is that portion of the bill which would authorize the National Science Board to delegate specific authority to its Executive Committee or to the Director to approve grants or contracts between meetings of the Board in certain situations as determined by the Board. The present rigid requirement, as pointed out in the Foundation's analysis of the draft bill presented to the Congress (which analysis was introduced into the record at our hearing before this committee on May 14, 1958), has created some difficult problems for efficient operation in several instances as, for example, in connection with grants for supplies for the scientific expedition to Antarctica in connection with the International Geophysical Year where time was of the essence. Under the proposed change, the Board could delegate specific authority to its Executive Committee or to the Director to approve grants or contracts between meetings of the Board in certain situations. The Board, of course, would still retain complete power to grant such authority or not, as the entire Board might see fit.

Another example of a technical change is that portion of the bill which would delete the words "accredited" and "of higher education" from section 10 of the act so as to take care of the relatively rare situation where the successful competitor for a fellowship wishes to study or work at a research institution in his field which is not an educational institution, such as one of the National Institutes of Health.

In addition to technical changes, the bill proposes amendments designed to improve the exchange of scientific information among scientists in the United States and those in foreign countries and to facilitate scientific activities abroad which we believe will result in additional benefit to the scientific community in the United States and in the free world. Thus, the Foundation is requesting authority to award fellowships to foreign nationals for scientific study or work in the same manner as is now being done in connection with American citizens. The Secretary of State would have to approve any such programs so as to make certain that such programs were carried out in accordance with the foreign policies of the United States.

Section 9 of H. R. 11257, as introduced, would amend the National Science Foundation Act to authorize the assignment of Foundation employees for training. We recommend that section 9 be stricken from the bill in view of the fact that the Congress has recently passed legislation, contained in Public Law 507 of this Congress, which would give such authority to various agencies, including the Foundation.

We believe that, if the amendments requested are enacted by the Congress, they will be a substantial contribution toward more efficient operation of the Foundation and will greatly assist the Foundation in carrying out its responsibilities.

Thank you, Mr. Chairman, for the opportunity to make this statement. I shall be happy to answer any questions you might have.

Dr. WATERMAN. I will summarize it. The chief purpose in proposing these legislative changes is for clarification of the National Science Foundation Act which has served extremely well. This has been commented on very many times by our National Science Board; it has been most effective in general.

One of the most important of the changes suggested is a simplification in view of the volume of business the Foundation has. At the present time it is necessary, according to our act, that our National Science Board of 24 members approve each separate research grant and each separate fellowship which is awarded by the Fundation. When one considers that in the past year, for example, the Board had to approve 1,100 research grants and approximately $19 million in funds, the workload on the staff and the Board to prepare these for individual review seems excessive.

At the time the act was established there was a limitation of $15 million which made the work more manageable. As one can see, with

the increased responsibilities of the Foundation, the prospect of passing on individual grants is discouraging.

The suggestion, therefore, for this change in legislation is, in my own words, to make it possible, permissive, for the Board, at its discretion, to allow authority to the Director or to its Executive Committee to approve research grants and fellowships. This is entirely at its discretion in such circumstances as it sees fit.

This would simplify our procedure very greatly and in view of the volume of business we have, it seems to be a very necessary suggestion.

The other points are more or less minor ones. One would delete the word "accredited" and the phrase "of higher education" from section 10 of the act which deals with the award of a fellowship.

At the present time a fellowship can only be awarded to someone who is to go to an accredited institution of higher education.

There are some fellows who wish to work at say a nonprofit institution which is not for higher education.

Mr. WILLIAMS. This is still restricted to nonprofit institutions?

Mr. WATERMAN. That is correct, or wherever it is not important for the basic research to be done. The word "accredited" is not applicable in those cases. "Of higher education" may not be applicable either. The suggestion was to eliminate those phrases.

Mr. WILLIAMS. Several months ago this committee visited a privately operated laboratory on Long Island in regard to food additive legislation. Dr. Oser, whom you may know, is head of that laboratory. I presume that is a laboratory operated for profit. I do not know.

Assuming that laboratory should be one that is a nonprofit laboratory and operated on a cooperative basis as we have so many businesses of that type now, would that in that case qualify under this change in the law?

Mr. WATERMAN. It could certainly; yes, sir. We have the word "appropriate" here instead of "accredited." That would, I think, cover all cases. After all, if a man gets a fellowship to do a piece of work, one wants him to go where the authorities are competent. That could be in a number of places, not necessarily educational institutions, and not necessarily a formally accredited one. This would make that permissive.

A minor change, too, associated with my first point on the approval required at present by the board of research grants and fellowships, would be to change the membership of the Executive Committee to make it permissive to have it not less than 5 nor more than 9. The present act has it that the Executive Committee shall consist of 9 members. This would be in the interest of expediting the work of the Committee. This would mean the Board itself would determine whether the Executive Committee should be 5 or 9 somewhere in between. It is a rather minor change.

Another change in the fellowship regulations, again a minor one, the act now says selections of fellows shall be made solely on the basis of ability. We should like to insert "demonstrated and potential ability." It may be one or the other or a combination. That would clarify a bit what one has in mind. In the case of a young man it is potential.

Mr. WILLIAMS. How do you measure potential ability?

Mr. WATERMAN. That is harder, but one has to make a decision in the case of the young person who has not had much chance to demonstrate.

Mr. WILLIAMS. You cannot measure his potential ability without taking into consideration his demonstrated ability, can you?

Mr. WATERMAN. There is a distinction. He has not demonstrated perhaps that he can do the particular research he wants to do but his past record demonstrates that he has potential ability to do it.

Mr. NEAL. It is a matter of personal evaluation, is it not?

Mr. WATERMAN. Yes. You want to get his competence in any way possible.

Another is in section 11 in the making of contracts or grants or other arrangements for the carrying on of scientific activities by organizations or individuals in the United States or foreign countries, including other Government agencies of the United States or foreign countries, to change the wording to omit the words "basic" and "research," and to permit support of "such scientific activities as the Foundation deems necessary to carry out the purposes of this act" and similarly with respect to scientific activities undertaken at the request of the Secretary of Defense.

Mr. WILLIAMS. That section concerns me a little bit. In your statement you say this: "The purpose of this is to improve the exchange of scientific information among the various countries." You say, "Thus, the Foundation is requesting authority to award fellowships to foreign nationals for scientific study or work in the same manner as is now being done in connection with American citizens." Does this authorize you to grant a fellowship, for instance, to a German national to study at Heidelberg or at a German institution?

Mr. WATERMAN. It would permit that. One of the most important considerations here would be to award fellowships to a foreign national that might be for work in this country or perhaps some other country than his own.

Mr. WILLIAMS. I understand that, but assuming we award this to a French student to study in Germany, that raises a question in my mind as to where is our constitutional authority for doing that.

Mr. WATERMAN. This would only be done with the approval of the Department of State in all such cases.

Mr. WILLIAMS. I am talking about the Constitution now. The power of Congress, as we have gone over before, to spend the taxpayers' money is limited exclusively, as you know, to that authority that is delegated to the Federal Government by the States in the Constitution or by the people. The Federal Government can exercise only such authority as is delegated to it in the Constitution.

Mr. WATERMAN. Yes.

Mr. WILLIAMS. I am wondering when we get into the proposition of subsidizing the education of persons in other countries, just where is our constitutional authority for doing that type of thing? I am not speaking of the merits of the program. I am speaking of where is the authority of Congress to legislate in that field. I know you are not a lawyer and it probably is not a fair question to ask.

Mr. WATERMAN. I cannot answer you directly. The idea is if we are interested in a particular topic in very fundamental basic research and there is a foreign national who is highly expert and there is a place abroad where he might work, it would be to our advantage to support him because he has to give a report to the Foundation of what he does. This would be a matter of record for us. This would be our national interest in doing it on that basis. The constitutionality of it I could not answer.

Mr. WILLIAMS. Of course, that brings up the practical question of how do we maintain control over his activities in a foreign country. Assuming we spend this money on him to develop certain information for us and he reneges in giving us that information——

Mr. WATERMAN. We have to look into that to be sure this is part of the decision in making the award.

Mr. WILLIAMS. We will cross that bridge when we get to it. Go ahead, if you like.

Mr. WATERMAN. The other was, you will notice, to make it possible to facilitate scientific activities instead of just the narrower support of basic research activities abroad. This comes about in this way. While we can, of course, support research projects abroad, there are circumstances where it would be helpful to support, say, a conference on research or an organization which is building up research and supporting it.

In that case we are not supporting only the research but the preparations and arrangements that are made. It is a matter of clarification to permit that latitude. We find in practice there are cases where it would be helpful to facilitate the research in a broader sense than just applying the money to the performance.

Mr. WILLIAMS. With regard to the international phase of this bill, has the Foundation given any thought to working out some type of agreement with this international WPA that we are operating to get some of their money to do this work? Mutual security, I am speaking of.

Mr. WATERMAN. We are in close relation with the mutual security people and ICA so that what we can do is well coordinated with what they do. Is that the purpose of your question?

Mr. WILLIAMS. It appears that here is an opportunity for us to get a little good out of that mutual security program. We have not gotten any in about 12 years now. Here is a chance to get a little something for the American taxpayer by securing support of the National Science Foundation. I am wondering if this should come out of your appropriations or if we should not put the squeeze on those who benefit from the mutual security program.

Mr. WATERMAN. The recent decision by the Congress to make available counterpart funds for scientific activities overseas is very much to our advantage. We have looked into that and there are cases we can proceed with.

Mr. WILLIAMS. Why should this not be done exclusively with counterpart funds?

Mr. WATERMAN. This would depend on the countries where we have counterpart funds, I believe. That would be a restriction.

Mr. WILLIAMS. Is there any country in the world where we do not have counterpart funds?

Mr. WATERMAN. I could not answer that, sir.

Mr. WILLIAMS. I can see some good to come of this if we can take it out of the mutual security program. I hesitate to tax the American people to educate foreign nationals.

Mr. WATERMAN. We are well aware of that, sir, and we have followed this through with the mutual security people. We have in mind things that can be done. We are very pleased with this action of Congress which will make this clearly possible.

I am sure that we would always look into this before we do it otherwise. There is such an obvious advantage.

Mr. WILLIAMS. Mr. Rhodes?

Mr. RHODES. No questions.

Mr. WILLIAMS. Mr. Neal?

Mr. NEAL. No questions.

Mr. WILLIAMS. Mr. Bush?

Mr. BUSH. Are there any of these foreign countries who assign fellowships to our country in science?

Mr. WATERMAN. The Fulbright fellowship program is one where we are interested. Other countries do have fellowships for travel abroad.

I could not, offhand, say what the volume of business is but the fellowship is a very common subsidy in any country. The countries vary in the number they have available. This country gets a great many people who come to us in that way.

Mr. BUSH. That is all.

Mr. WILLIAMS. Mr. Waterman, it is 5 minutes after 11 o'clock, and I suspect that the committee will have to adjourn.

We may or may not, depending on the feeling of the committee, ask you to come back on this bill. I cannot say at the moment but in the event the committee does decide to hear from you further, I am sure that you will be available?

Mr. WATERMAN. I will be ready at any time, Mr. Chairman.

Mr. WILLIAMS. Thank you very much.

The committee will stand adjourned.

(The following material was submitted for the record.)

AMERICAN CHEMICAL SOCIETY,
Washington, D. C., June 9, 1958.

Hon. JOHN BELL WILLIAMS,
House of Representatives,
Washington, D. C.

DEAR SIR: The present challenge to America science and technology has been a matter of deep concern to members of the American Chemical Society. At its most recent meeting our board of directors formulated and adopted a statement of policy which was received with approval by the council, the popular deliberative assembly of the society. Attached is a copy.

This statement is transmitted because the society is fully aware of your deep and genuine interest in the development of sound legislation for strengthening scientific research and education. The American Chemical Society, a federally chartered organization with more than 84,000 professional members, wishes to be of assistance. For years it has been concerned about problems such as we are now facing and it has initiated positive remedial programs. The society's statement of policy on specialized personnel (1955) and another on matters relating to education (1956) both were received favorably by Congressmen.

The American Chemical Society pledges its cooperation in efforts to implement the recommendations in our policy statement. We hope that you will find them worthy of your thoughtful consideration.

Very truly yours,

ALDEN H. EMERY, *Executive Secretary.*

[Reprinted from the Chemical and Engineering News]

STATEMENT OF POLICY BY THE BOARD OF DIRECTORS OF THE AMERICAN CHEMICAL SOCIETY ON THE PRESENT CHALLENGE TO AMERICAN SCIENCE AND TECHNOLOGY

Events of the past several months have made the American people aware, as never before, of the importance of science and technology to their continuing welfare and security. This awareness has prompted many proposals for accelerating scientific progress, particularly in the military field, and for strengthening our educational system to assure the training of highly qualified scientists and engineers to meet the Nation's future needs.

These are problems with which the American Chemical Society has been actively concerned for years. In World War II, for example, the society warned the Nation of the unfortunate effects on our scientific and technical manpower of certain selective-service policies, which ultimately were corrected. The society has pointed repeatedly to weaknesses in the educational system, and has suggested remedies. The need for a more favorable climate for the work of scientists and engineers has constantly been stressed.

In the light of recent developments, it seems appropriate at this time for the board of directors of the society to reemphasize many of the views it has expressed previously, and to offer some additional recommendations.

With national defense increasingly dependent upon continuing technological progress, the present situation poses a two-fold challenge to the United States: that of maintaining the country's immediate security, and that of doing whatever is necessary to insure its safety 10 to 30 years from now.

The immediate danger is essentially military, and must be met with the men and other resources now available. The long-range danger is far more complex, and can best be met by a comprehensive program to strengthen the American educational system.

In the military area, research and development work is of prime importance. As now organized, these activities are divided among three services—the Army, Navy, and Air Force. Although some research and development work is applicable to only 1 service, many projects are of equal interest to 2 or all 3 services. For this reason, greater centralization of military research seems desirable. To be most effective, such a program should be under a director reporting to the Secretary of Defense and should have adequate financial support.

With respect to nonmilitary research and development activities of the Government, this board believes that a comparable situation exists and that here, too, greater centralization is in order. Those research and development programs of concern to more than one agency could well be combined under a director who would have adequate funds for his operations and who would report to the President. This director would be in a position to advise the top policy councils of the Government on scientific matters.

Research and development works is almost always done on a project basis. The very nature of research—exploration of the unknown—makes exact scheduling difficult, if not impossible. Most projects of significance cannot be finished in a year; many require several years. The system of awarding funds annually, in common use at present, often interferes with efficient operations. Therefore, this board recommends that Congress adopt as a general policy the granting of research funds on a long-range basis to cover those projects which obviously will require more than a year.

The long-range challenge to the United States requires substantial improvement of our educational system to train properly leaders in science, technology, and other vital fields whom the Nation needs in the years ahead. Much more emphasis, therefore, must be placed upon maximum intellectual development as the main goal of education.

This board recognizes the need for the education of all in a democracy, and the consequent need for a variety of courses to meet the requirements and interests of students of differing abilities. The board believes, however, that the time has come to make a clear distinction at every educational level between fundamental courses—such as the sciences, mathematics, languages, and the humanities—which contribute to intellectual growth, and courses which do not. Once this distinction has been established, scholarships, awards, and college entrance requirements should be based largely on accomplishment in fundamental courses. Thus will encourage superior students to concentrate on fundamentals and will help parents to judge the value of their children's studies.

Important though greater emphasis upon fundamental subjects may be, it will accomplish little if our schools and colleges lack competent teachers of those subjects. There is ample evidence of a teacher shortage which can be attributed largely to low salaries and low prestige. This situation must be corrected.

This board believes that teacher training practices should be modified in many States. Teacher certification standards should be based primarily on knowledge of subjects to be taught.

Science has moved so rapidly that curricula, textbooks, reference materials, teaching aids, and tools of communication are often outmoded. Modernization is urgently needed to increase the effectiveness of teachers.

Elementary and secondary education in the United States is under local control, and the support of school boards, parents, and taxpayers is necessary for

improvements. Many of the 151 local sections and 83,000 individual members of the American Chemical Society have worked in their own communities toward these goals. The board recommends that such efforts be continued and intensified.

It is recommended, also, that efforts to build public understanding of the work of scientists and the meaning and importance of scientific progress be increased. The press, radio, television, and all other available media should be used for this purpose.

Basic research is another area in which greatly increased activity is imperative. Broader support is needed for basic research in the United States to assure a proper balance with technology. Basic research seeks new knowledge of the laws of nature, regardless of immediate practical value. Technology applies basic scientific information to the solution of practical problems, including the development of new weapons. Because of intense technological competition among nations, the country which leads in basic research is most likely to lead in technology.

To sum up, the board of directors of the American Chemical Society offers the following recommendations to meet the present challenge to American science and technology:

1. Greater centralization of military research, with adequate financial support, under a director reporting to the Secretary of Defense.

2. Greater centralization of the Government's nonmilitary scientific and technological activities, with adequate financial support, under a director reporting to the President.

3. Adoption by Congress of a policy whereby research funds could be granted on a long-range basis, so that projects requiring more than 1 year could be planned and executed more efficiently.

4. Restoration of emphasis in school and college curricula upon courses contributing to intellectual development through—

(*a*) Evaluation of courses on the basis of the intellectual challenge they offer;

(*b*) Recognition of achievement in the more intellectually challenging courses as the basis for college entrance and for scholarship grants and awards.

5. Improvement of incentives to attract highly qualified men and women to the teaching profession through—

(*a*) Adequate compensation, with increases based mainly on merit and on subject matter training and experience;

(*b*) Increased prestige, based on greater opportunities for self-improvement and wider public recognition of the contributions of teachers to the national welfare and security.

6. Investigation and development of more modern curricula, textbooks, reference materials, teaching aids, and tools of communication to improve the effectiveness of teachers.

7. Modification of teacher training practices and certification standards in many States to increase emphasis on knowledge of subjects to be taught.

8. Continued and increased efforts by local sections and individual members of the American Chemical Society to strengthen the school systems of their own communities.

9. Increased efforts, through all media, to build public understanding of the work of scientists and the meaning and importance of scientific progress.

10. Broader support of basic research in the United States.

AMERICAN CHEMICAL SOCIETY DIRECTORS ISSUE 10 RECOMMENDATIONS TO MEET THE PRESENT CHALLENGE FOR AMERICAN SCIENCE AND TECHNOLOGY

This issue (p. 22) contains a statement of policy by the board of directors of the American Chemical Society on the present challenge to American science and technology, as reported by Chairman Ralph Connor to the ACS Council at the meeting in San Francisco.

Four comments are in order:

1. The statement was issued only after long and serious study which extended over a number of months.

2. Only broad objectives are enunciated. Specific and detailed proposals on how these objectives should be implemented are not included. The board felt that the administration, Congress, and the State and local government agencies can and will provide the necessary ways and means of assuring full achieve-

ment of these objectives once their vital importance to our future welfare is made abundantly clear.

This is not to say that some members of the board did not feel the need for spelling out at this time more specific recommendations. However, Dr. Connor proposed these be held in abeyance; possibly they may be more effective if presented later.

3. While all 10 of the broad recommendations are of personal interest to each society member, many of them offer special challenges in the way of collective action to local sections and to divisions of the society. As chemists and chemical engineers and as citizens, it is our personal duty and responsibility to give of our time and our efforts to find practical solutions to the greatest challenge our country and the free world has been confronted with in the annals of modern history.

4. While the statement issued by the board comes after the advent of Sputniks I and II, several of the recommendations essentially are restatements of policies previously proposed.

Agreement on the broad objectives poses no problems. But it may be difficult to agree on specific methods of implementation.

The recent parliament of science sponsored by the American Association for the Advancement of Science demonstrated conclusively that a number of areas exist where scientists disagree—such as the question of establishing a new Cabinet post for science similar to the one long established for labor. Once again it became obvious that unanimity of opinion is impossible at this time. This is not to say, however, that further debate and exchange of ideas and opinion cannot and will not lead to agreement on certain aspects which, at the moment, are highly controversial.

Scientists and technologists have been criticized by some members of Congress for failing to be vocal on matters that relate to the impact of science on the general welfare and safety of this country. To some extent this criticism is justified. Traditionally, scientific and technical societies have directed their major attention to the progress of science and technology without regard to its effect on the social, political, economic, and even military life of the nation. No longer can these effects be ignored by scientists and technologists.

The 10 recommendations proposed by the board cover very broad areas where new approaches must be adopted if the United States is to continue to give needed leadership in a very troubled world. Each member of the society must continue to remember that recommendations, as such, mean little unless they stimulate people to positive action.

Some members of the society have been critical of it for not providing greater leadership on matters where science and the public interest are involved. This void, if it has existed, has been admirably filled by the recent action of the board of directors.

From this point on, much of the responsibility rests with us as individuals and with the officers of local sections. It is at the grass-roots level that the greatest good can be accomplished.

(Whereupon the subcommittee adjourned.)

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